Food and Agriculture Organization of the United Nations

STATUS OF, AND TRENDS IN, THE GLOBAL CORE SET OF FOREST-RELATED INDICATORS

CPF Collaborative Partnership on Forests | CIFOR | CITES | Convention on Biological Diversity | Food and Agriculture Organization of the United Nations | gef | ITTO | IUCN

IUFRO | United Nations Convention to Combat Desertification | UNDP | UN environment programme | DEPARTMENT OF ECONOMIC AND SOCIAL AFFAIRS | United Nations Climate Change | World Agroforestry | THE WORLD BANK

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Food and Agriculture Organization of the United Nations
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Acronyms and abbreviations

CBD	Convention on Biological Diversity
CFRQ	Collaborative Forest Resources Questionnaire
CIFOR-ICRAF	Center for International Forestry Research and World Agroforestry
CO_2	carbon dioxide
COVID-19	coronavirus disease
CPF	Collaborative Partnership on Forests
FAO	Food and Agriculture Organization of the United Nations
FRA	Global Forest Resources Assessment
FSC	Forest Stewardship Council
FSN	food security and nutrition
FTE	full-time equivalent
GCS	global core set of forest-related indicators
GFG	Global Forest Goal
GHG	greenhouse gas
GHGI	greenhouse-gas inventory
Gt	gigatonne(s)
ha	hectare(s)
IAM	integrated assessment model
ICLS	International Conference of Labour Statisticians
IEA	International Energy Agency
ILO	International Labour Organization
IRENA	International Renewable Energy Agency
IUCN	International Union for Conservation of Nature
kg	kilogram(s)
km	kilometre(s)
LULUCF	land use, land-use change and forestry
m	metre(s)
NWFP	non-wood forest product
PEFC	Programme for the Endorsement of Forest Certification
SDG	Sustainable Development Goal
SFM	sustainable forest management
SOFO	State of the World's Forests
UNCCD	United Nations Convention to Combat Desertification
UNECE	United Nations Economic Commission for Europe
UNFCCC	United Nations Framework Convention on Climate Change
UNFF	United Nations Forum on Forests
UNSD	United Nations Statistics Division
UNSPF	United Nations Strategic Plan for Forests
USD	United States dollar(s)

Executive summary

This is an accompanying document of the FAO report, *State of the World's Forests 2022*. It provides an overview of a global core set of 21 forest-related indicators (GCS). For each indicator, the report addresses concepts and definitions, the rationale and scope of the indicator, and the available data.

GCS 1 – "Forest area as a proportion of total land area". Globally, the proportion of forest area fell from 31.9 percent of the total land area in 2000 to 31.2 percent in 2020. This represents a net loss of almost 100 million ha of the world's forests in two decades, with variations between regions. Forest area increased in Asia, Europe and Northern America between 2000 and 2020, but there were significant decreases in Latin America and the Caribbean and sub-Saharan Africa. Challenges remain in obtaining accurate information for this indicator and in providing annual updates.

GCS 2 – "Annual forest area change rate". There was a slight decrease in the annual forest-area change rate from -0.13 percent in 2000–2010 to -0.12 percent in 2010–2020. This amounts to a decrease in annual forest loss globally from -5.2 million ha in 2000–2010 to -4.7 million ha in 2010–2020. The rate of forest loss increased in Africa and South-Eastern Asia in 2010–2020 compared with the previous decade and was still high but slowing in Latin America and the Caribbean.

GCS 3 – "Net greenhouse-gas emissions (source)/removals (sink) of forests, and carbon balance of harvested wood products". Measures related to land use, land-use change and forestry (LULUCF) represent about 25 percent of the greenhouse-gas emission reductions pledged by countries in their nationally determined contributions under the Paris Agreement. Near-constant gross emissions from LULUCF estimated at 14 ± 2 $GtCO_2$ per year in 2011–2020 were offset only partly by carbon removals on managed land of 10 ± 1.5 $GtCO_2$ per year, resulting in net emissions from managed land of 4.1 ± 2.6 $GtCO_2$ per year over the period. High uncertainties exist on estimates of LULUCF contributions to sources and sinks of greenhouse gases.

GCS 4 – "Proportion of forest area within legally established protected areas". Eighteen percent of the world's forest area (726 million ha) is in legally established protected areas such as national parks, conservation areas and game reserves. Of the main regions, Latin America has the highest share of forests in protected areas, at 31 percent, followed by sub-Saharan Africa (26 percent) and Northern Africa and Western Asia (25 percent). The area of forests in protected areas globally increased by 191 million ha between 1990 and 2020, but the rate of annual increase in this area slowed in 2010–2020.

GCS 5 – "Change in area of primary forests". The area of primary forests worldwide (146 countries and territories reporting to FAO's Global Forest Resources Assessment – FRA – in 2020) in 2020 was estimated at 1.11 billion ha, or about one-third (34 percent) of the forest area of reporting countries and territories. Globally, the area of primary forest decreased by 81.3 million ha between 1990 and 2020 and the rate of loss in 2010–2020 was estimated at 1.27 million ha per year. The highest rate of loss between 2010 and 2020 was in Western and Central Africa (from 97 million ha to 88 million ha), followed by South America (from 301 million ha to 298 million ha).

GCS 6 – "Proportion of forest area disturbed". In 2015 (the latest year for which data are available globally), the total forest area affected by disturbances (as reported to FRA 2020) amounted to 30.2 million ha in 62 countries and territories (1.4 percent of the total forest area of those countries) for insects; 6.60 million ha in 51 countries and territories (0.4 percent of the forest area of those countries) for diseases; 3.83 million ha in 48 countries and territories (0.3 percent of the forest area of those countries) for severe weather events; and 98 million ha in 118 countries and territories (3 percent of the forest area of those countries) for forest fire.

GCS 7 – "Area of degraded forest". Fifty-eight countries, representing 38 percent of the global forest area, reported to FRA 2020 that they monitored the area of degraded forest. The lack of a universally applied definition of forest degradation means that data on the area of degraded forest cannot be aggregated at the regional and global levels.

GCS 8 – "Aboveground biomass in forest". The aboveground biomass in the world's forests was estimated at about 118 tonnes per ha in 2020, up from about 117 tonnes per ha in 2010, with the highest value in Latin America and the Caribbean.

GCS 9 – "Volume of wood removals". Global wood removals were estimated at 3.97 billion m^3 in 2018, of which about half was industrial roundwood and the other half woodfuel. This was a 10 percent increase from 2010, when the volume of wood removals was estimated at 3.59 billion m^3. Wood removals increased steadily in Africa between 1990 and 2018, from 506 million m^3 to 779 million m^3. Removals in Europe (including the Russian Federation) reached a record 824 million m^3 in 2018.

GCS 10 – "Share of wood-based energy in total final energy consumption". The share of wood energy in total final energy consumption globally declined from 10.3 percent in 1971 to 5.8 percent in 2018. There are considerable challenges in generating good-quality data on wood energy.

GCS 11 – "Forest area with a designated management objective to maintain and enhance its protective functions". Globally, the area designated primarily for the protection of soils and water in 2020 was estimated at 398 million ha (for 141 countries and territories reporting to FRA 2020 representing 82 percent of the total forest area). This was an increase of 119 million ha compared with 1990 (for 131 countries and territories that reported time-series data on this parameter). Europe has the largest area of forest designated primarily for soil and water protection, at 171 million ha (18 percent of the region's total forest area), followed by Asia, at 132 million ha (22 percent of the forest area – the largest proportion of any region).

The area designated primarily for biodiversity conservation in 2020 was estimated at 424 million ha (for 165 countries reporting to FRA 2020, representing 91 percent of the world's forest area). The largest area of forest so designated was in Africa, at 107 million ha, and the lowest proportion was in Europe, at 4 percent.

GCS 12 – "Employment related to the forest sector". The estimated number of people employed in the forest sector globally in 2017–2019 was about 33 million, 80 percent of whom were in Asia and Africa. Overall, there was a downward trend in forest-based employment over the decade to 2019, strongly influenced by the decreasing number of people employed in the wood-based manufacturing subsectors.

GCS 13 – "Number of forest-dependent people in extreme poverty". An estimated 3.27 billion and 4.17 billion people globally lived within 1 km and 5 km, respectively, of a forest in 2019, representing 75 percent and 95 percent, respectively, of the total rural population. Work is underway to develop methodologies for superimposing poverty data on forest-proximity data as a next step in reporting on this indicator.

GCS 14 – "Contribution of forests to food security and nutrition". Forests, trees and agroforestry systems make diverse contributions to food security and nutrition, and encompassing these in a single indicator is challenging. The following five subindicators have been proposed to help measure this indicator using existing data: (1) employment provided by forests and trees; (2) consumption of woodfuel per capita; (3) consumption of fruit per capita; (4) consumption of nuts per capita; and (5) percentage of farming households with part of their livelihoods derived from forests and trees. Data on the contributions of forests to food security and nutrition are not yet collected systematically by all countries and territories.

GCS 15 – "Financial resources from all sources for the implementation of sustainable forest management". Comprehensive global data on this indicator and its trends are currently unavailable. This lack of information is a major barrier to an improved understanding of the true costs associated with the management of all types of forests and the potential of forests to contribute to sustainable development.

GCS 16 – "Existence of national or subnational policies, strategies, legislation, regulations and institutions which explicitly encourage sustainable forest management". In reporting to FRA 2020, 164 countries and territories (representing about 99 percent of the total forest area) indicated that they have national forest policies. The large majority also reported that they have national-level policy statements, and 172 countries and territories representing 99 percent of the total forest area indicated that they have forest legislation.

GCS 17 – "Existence of national or subnational forest assessment processes". There is no commonly agreed definition of this indicator. An assessment of national forest monitoring capacities based on reports submitted by countries found that, overall, data quality greatly improved in FRA 2020 compared with FRA 2015 (for the assessed indicators), indicating that many countries produced new data and are considerably improving their monitoring and reporting on forests.

GCS 18 – "Existence of national or subnational stakeholder platform for participation in forest policy development". A total of 142 countries and territories representing 95 percent of the total forest area reported to FRA 2020 that they have platforms to enable the participation of stakeholders in forest policy development; 40 countries and territories indicated that they do not have such a platform and 54 did not report.

GCS 19 – "Proportion of forest area under a long-term management plan". Globally, the area of forest under management plans has grown by 233 million ha since 2000, reaching 2.05 billion ha in 2020, with increases in all regions. Most (96 percent) forests in Europe have management plans; on the other hand, management plans exist for less than 25 percent of forests in Africa and less than 20 percent of forests in South America.

GCS 20 – "Forest area under an independently verified forest management certification scheme". The total net certified forest area reported by the two main certification bodies in 2021 was 463 million ha, with almost 60 percent of this area in three countries – Canada (165 million ha), the Russian Federation (72.3 million ha) and the United States of America (39.8 million ha).

GCS 21 – "Existence of traceability system(s) for wood products". Ninety-four countries and territories reported to FRA 2020 the existence of traceability systems for wood products at the national level in 2020 and another three reported that such systems exist at the subnational level; in total, these 97 countries and territories represent 84 percent of the total forest area.

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Introduction

In recent years, the international community has articulated many goals related to forests in the broader development context, including the Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development, the Rio conventions (that is, the Convention on Biological Diversity – CBD, the United Nations Convention to Combat Desertification – UNCCD, and the United Nations Framework Convention on Climate Change – UNFCCC), and instruments focused on the forest sector. Among the latter, the United Nations Strategic Plan for Forests (UNSPF) 2017–2030 contains six Global Forest Goals (GFGs) and 26 associated targets to be achieved by 2030.

The Collaborative Partnership on Forests (CPF) is a voluntary partnership of major international agencies working on forests.[a] Since FAO's 2005 Global Forest Resources Assessment (FRA) (FAO, 2006), the FRA secretariat has been collaborating with CPF members to further improve definitions and streamline reporting. The consultative and collaborative relationship between the FRA secretariat and other international reporting processes and organizations involved in the collection of forest-related data led to the establishment of the Collaborative Forest Resources Questionnaire (CFRQ), which builds on the work done within the criteria and indicator processes, such as the Montréal Process and the Ministerial Conference on the Protection of Forests in Europe (FOREST EUROPE). The CFRQ has resulted in a significant reduction in the duplication of data-collection processes and consequently in the reporting burden on countries.

The strong commitment of the international community, and especially the CPF members, to provide the information necessary for monitoring progress towards global goals, targets and indicators in a comprehensive, efficient, timely and meaningful way led to the idea of developing a global core set of forest-related indicators (GCS). The aim was to simplify and harmonize concepts and terminology while respecting the needs of all potential users.

The concrete work on the GCS was initiated in 2016 through an organization-led initiative on the development of global forest indicators. Following the recommendation of this initiative, the CPF members established a GCS taskforce, which developed the GCS (Table 1). The GCS was presented to the United Nations Forum on Forests (UNFF) and FAO's Committee on Forestry, which welcomed the progress made in developing the GCS and acknowledged its value for assessing progress and better focusing data-collection efforts to reduce duplication. The two bodies also encouraged the application of those indicators that are ready to use (i.e. the tier 1 indicators in Table 1) and requested the CPF to continue developing the remaining indicators, particularly those that may require additional efforts but are manageable through various data sources (i.e. tier 2 in Table 1).

This is an accompanying document of the FAO report, *State of the World's Forests 2022* (SOFO 2022). It provides an overview of the GCS and presents the latest data on the status and trends of the 21 indicators. SOFO 2022, which examines three potential forest pathways for addressing global challenges, is available separately.

[a] The CPF comprises the Center for International Forestry Research (CIFOR); the CBD; the Convention on International Trade in Endangered Species of Wild Fauna and Flora; the Food and Agriculture Organization of the United Nations (FAO); the Global Environment Facility; the International Tropical Timber Organization; the International Union for Conservation of Nature (IUCN); the International Union of Forest Research Organizations; the UNCCD; the United Nations Development Programme; the United Nations Environment Programme; the UNFCCC; the World Agroforestry Centre (ICRAF); and the World Bank.

Table 1. *The global core set of forest-related indicators, their classification tiers, and links to globally agreed goals and targets*

NO.	TITLE	TIER[b]	DATA SUPPLIER	LINKS TO GLOBAL GOALS AND TARGETS
1	Forest area as a proportion of total land area	1	FAO	Measures progress towards GFG 1 and SDG target 15.1 (SDG indicator 15.1.1)
2	Annual forest area change rate[c]	1	FAO	Measures progress towards SDG target 15.2 and UNSPF target 1.1. A subindicator of SDG 15.2.1
3	Net greenhouse-gas emissions (source)/removals (sink) of forests, and carbon balance of harvested wood products	2	UNFCCC	Measures progress towards SDG 13 and UNSPF targets 1.2 and 2.5. Relevant to measuring, reporting and verifying requirements under the UNFCCC
4	Proportion of forest area located within legally established protected areas	1	FAO	Measures progress towards SDG 15.2, UNSPF targets 2.5 and 3.1 and the post-2020 global biodiversity framework. A subindicator of SDG 15.2.1
5	Change in area of primary forests	1	FAO	Measures progress towards SDG 15.3, UNSPF target 1.3 and the post-2020 global biodiversity framework
6	Proportion of forest area disturbed	2	FAO	Measures progress towards UNSPF target 1.4
7	Area of degraded forest	3	FAO	Measures progress towards SDG 15.3 and UNSPF target 1.3. There are linkages with SDG target 15.3, the post-2020 global biodiversity framework, UNCCD Strategic Objective 1, and the UNFCCC
8	Aboveground biomass stock in forest	1	FAO	Measures progress towards SDG 15.2, UNSPF target 1.2 and 2.5 and the post-2020 global biodiversity framework. A subindicator of SDG 15.2.1
9	Volume of wood removals	1	JFSQ	Measures progress towards UNSPF target 2.4
10	Share of wood-based energy in total final energy consumption	2	FAO and UNECE	Measures progress towards SDG target 7.2 and SDG 15.2
11	Forest area with a designated management objective to maintain and enhance its protective functions	1	FAO	Measures progress towards UNSPF target 1.4
12	Employment related to the forest sector	2	FAO and ILO	Measures progress towards UNSPF target 2.4
13	Number of forest-dependent people in extreme poverty	3	FAO and UNFF	Measures progress towards GFG 2 and its target 2.1
14	Contribution of forests to food security and nutrition	3	FAO and UNFF	Measures progress towards GFG 2 and its target 2.3
15	Financial resources from all sources for the implementation of sustainable forest management	3	OECD and World Bank	Measures progress towards GFG 4 and its targets 4.1 and 4.2. There are linkages with SDG targets 15a and 15b

[b] Tier 1 indicators are those for which there is a methodology and data can be readily collected. Tier 2 indicators are those for which there is a methodology but additional efforts are required to collect data. Tier 3 indicators are those for which the methodology needs to be determined, data are generally lacking, and data collection poses significant challenges (Anonymous, 2019).

[c] Name updated to reflect the change in the name of the corresponding SDG 15.2.1 subindicator. Some other GCS indicators have been edited for clarity.

NO.	TITLE	TIER[b]	DATA SUPPLIER	LINKS TO GLOBAL GOALS AND TARGETS
16	Existence of national or sub-national policies, strategies, legislation, regulations and institutions which explicitly encourage sustainable forest management	1	FAO	Measures progress towards GFG 5
17	Existence of national or subnational forest assessment process	1	FAO	Measures progress towards UNSPF target 4.5
18	Existence of national or subnational stakeholder platform for participation in forest policy development	1	FAO	Measures progress towards UNSPF target 4.5
19	Proportion of forest area under a long-term forest management plan	1	FAO	Measures progress towards SDG 15.2, UNSPF targets 1.3 and 3.2 and the post-2020 global biodiversity framework. A subindicator of SDG 15.2.1
20	Forest area under an independently verified forest management certification scheme	1	FAO	Measures progress towards SDG 15.2 and UNSPF targets 1.3 and 3.3. A subindicator of SDG 15.2.1
21	Existence of traceability system(s) for wood products	2	FAO	Measures progress towards UNSPF target 3.3 and 5.2

Note: FAO = Food and Agriculture Organization of the United Nations; JFSQ = Joint Forest Sector Questionnaire; GFG = Global Forest Goal; OECD = Organisation for Economic Co-operation and Development; SDG = Sustainable Development Goal; UNCCD = United Nations Convention to Combat Desertification; UNECE = United Nations Economic Commission for Europe; UNFCCC = United Nations Framework Convention on Climate Change; UNFF = United Nations Forum on Forests; UNSPF = United Nations Strategic Plan for Forests 2017–2030.

Source: Adjusted from United Nations Department of Economic and Social Affairs, United Nations Forum on Forests Secretariat (2021). *The Global Forest Goals Report 2021*.

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GCS
1
TIER 1

Forest area as a proportion of total land area

CONCEPTS AND DEFINITIONS

FAO defines "forest" as land spanning more than 0.5 ha with trees higher than 5 m and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. The definition does not include land that is predominantly under agricultural or urban land use. "Land area" for a country is defined as the area of that country, excluding the area under inland waters and coastal waters.

This indicator is the same as SDG indicator 15.1.1, for which FAO is the custodian agency.

RATIONALE/SCOPE

This indicator provides a measure of the relative extent of forest in a country. Accurate data on a country's forest area is an important metric for forest policy and planning in the context of sustainable development. Changes in forest area reflect demand for land for other uses and may help identify unsustainable practices in the forest and agriculture sectors. Forest area as a percentage of total land area may be used as a rough proxy for the extent to which forests in a country are being conserved or restored, but it is only a partial measure of the extent to which they are sustainably managed.

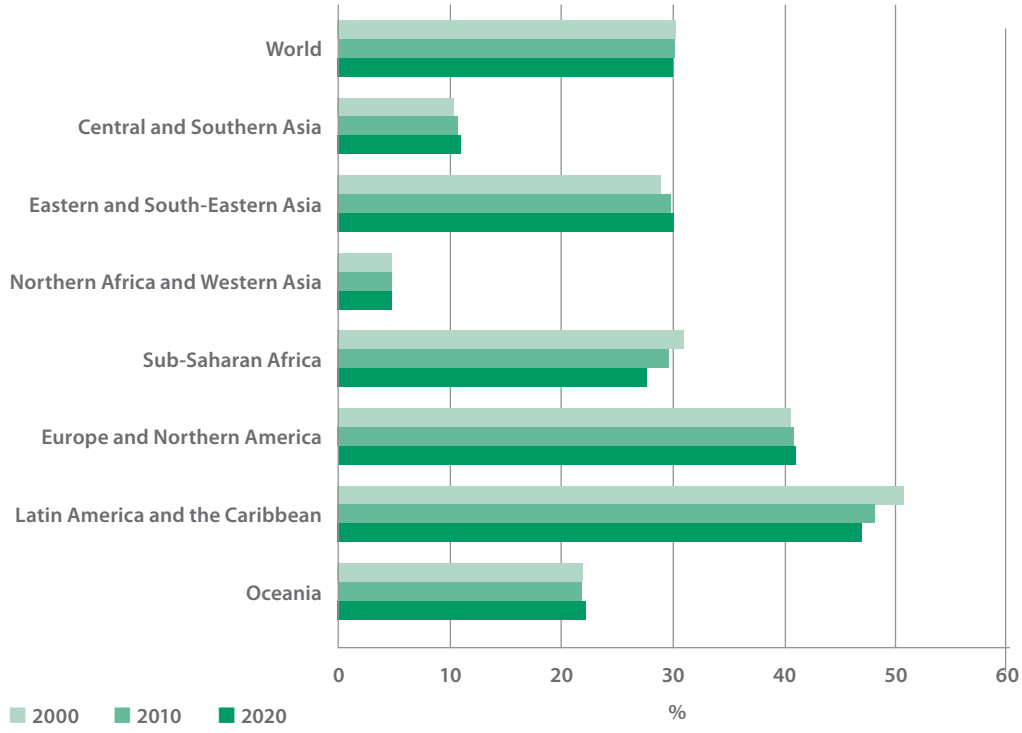
This indicator measures progress towards GFG 1 and SDG target 15.1.

Tier. This is a tier 1 indicator.

DATA

Description. FAO collects data on forest area through its FRAs, which have been conducted regularly since 1946 and are now produced every five years. The latest assessment, FRA 2020 (FAO, 2020, hereafter usually cited as FRA 2020), contains forest-area data for 236 countries and territories for 1990, 2000, 2010, 2015, 2016, 2017, 2018, 2019 and 2020. The next update of the complete FRA dataset is scheduled for 2025.

Figure 1. *Forest area as a proportion of total land area, globally and by region, 2000, 2010 and 2020*



Source: FAO. 2021. *Tracking progress on food and agriculture-related SDG indicators 2021 – A report on the indicators under FAO custodianship*. Rome.

Data on land area are collected from FAO members through the annual FAO Questionnaire on Land Use, Irrigation and Agricultural Practices. These sources were supplemented by data from national statistical yearbooks, other official government data portals and national and international sectoral studies and reports. Data on land area are updated annually and are available by country and year, covering up to 246 countries and territories for 1961–2018.

Status and trends. The annual update of indicator GCS 1 shows that the world's forest area continued to decrease, at a slightly slower rate than in previous decades. The proportion of forest area fell from 31.9 percent of the total land area in 2000 to 31.2 percent in 2020 (Figure 1). This represents a net loss of almost 100 million ha of the world's forests in two decades.

Changes in forest area varied widely between regions. Forest area increased in Asia, Europe and Northern America between 2000 and 2020, but there were significant losses of forest area in Latin America and the Caribbean and sub-Saharan Africa.[d]

[d] The SDG regional groupings are used for presenting data measuring progress towards SDG targets 15.1 and 15.2.

CHALLENGES AND LIMITATIONS

In many countries, assessments of forest area are carried out infrequently. Although increased access to remote sensing data can help some countries update their forest-area estimates more often, such estimates have certain challenges. For example, the assessment of forest area relates to land use but remote sensing primarily assesses land cover; gradual changes, such as forest regrowth, require several years to be detectable in satellite imagery; and forest areas with low canopy-cover density (e.g. 10–30 percent) can be difficult to detect at a large scale using affordable remote sensing techniques. The FRA's current five-year cycle means that it is not presently possible to produce annual updates of this indicator.

The potential for more frequent voluntary reporting to the FRA on forest area by countries is being evaluated.

GCS
2
TIER 1

Annual forest area change rate

CONCEPTS AND DEFINITIONS

The annual forest-area change rate is calculated as the compound annual change rate in forest area between two years, according to the following equation:

$$r = \left[\left(\frac{AF_{t2}}{AF_{t1}}\right)^{1/(t_2-t_1)} - 1\right] \times 100$$

where:

r = compound annual change rate for the period t_1 - t_2

t_1 = time 1

t_2 = time 2

AF_{t1} = forest area at t_1

AF_{t2} = forest area at t_2

The rate is expressed as a percentage and can be positive (forest-area gain), negative (forest-area loss) or null (no change in forest area).

This indicator is the same as one of the subindicators of SDG indicator 15.2.1, for which FAO is the custodian agency.

RATIONALE/SCOPE

Sustainable forest management (SFM) is a central concept in SDG 15 and associated targets 15.1 and 15.2. The United Nations General Assembly (2008) defines it as a "dynamic and evolving concept [that] aims to maintain and enhance the economic, social and environmental values of all types of forests, for the benefit of present and future generations". Thus, SFM is a concept that may vary over time and between countries and addresses a wide range of economic, social and environmental forest values and takes intergenerational equity into account. A single measure such as the annual forest-area

Figure 2. *Forest-area rate of change, 2000–2010 and 2010–2020, by region*

Note: The forest-area rate of change was calculated using the compound interest formula.

Source: FAO. 2021. *Tracking progress on food and agriculture-related SDG indicators 2021 – A report on the indicators under FAO custodianship*. Rome.

change rate is insufficient for monitoring SFM as a whole; therefore, this indicator is one of five SDG 15.2.1 subindicators for measuring progress in all dimensions of SFM.

The indicator focuses on the environmental values of forests, as signified in trends in forest area, looking at losses and gains in forest area and how the rate of change varies over time. The latter is important for capturing progress among countries that are losing forest area but have managed to reduce the rate of annual forest-area loss.

This indicator measures progress towards SDG target 15.2 and UNSPF 2017–2030 target 1.1.

Tier. This is a tier 1 indicator.

DATA

Description. Data on this indicator are collected by FAO through the FRA (see GCS 1 for a description of the FRA process). The next update of the complete FRA dataset is scheduled for 2025.

Status and trends. There was a slight decrease in the annual forest-area change rate from -0.13 percent in 2000–2010 to -0.12 percent in 2010–2020. This amounts to a decrease in forest loss globally from -5.2 million ha per year in 2000–2010 to -4.7 million ha in 2010–2020.

The indicator shows that the rate of forest loss increased in Africa and South-Eastern Asia[e] in 2010–2020 compared with the previous decade; the rate of forest loss was high but slowing in Latin America and the Caribbean (Figure 2).

CHALLENGES AND LIMITATIONS

In many countries, assessments of forest area are carried out infrequently. Although increased access to remote sensing data can help some countries update their estimates of forest-area change, such estimates have certain challenges, especially in forests with low canopy cover.

The FRA's current five-year cycle means it is presently not possible to produce annual updates of this indicator. The potential for more frequent voluntary reporting to the FRA by countries on key indicators is being evaluated.

[e] Reporting on the SDGs adheres to standard United Nations regional groupings and names.

GCS
3
TIER 2

Net greenhouse-gas emissions (source)/removals (sink) of forests, and carbon balance of harvested wood products

CONCEPTS AND DEFINITIONS

The UNFCCC (Article 1.4) defines emissions as "the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time". Greenhouse gases (GHGs) are defined as "those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation" (UNFCCC Article 1.5) and sinks as "any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere" (UNFCCC Article 1.8). Under Article 5.1 of the Paris Agreement (UNFCCC, 2016), "Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases … including forests".

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RATIONALE/SCOPE

Forests play an important role in the global carbon cycle, functioning both as a source of GHG emissions (through deforestation and degradation) and a sink (through carbon capture via photosynthesis and storage in biomass and soils).

Net GHG emissions (source) from, and removals (sink) by, forests are important indicators of the contributions of forests to climate-change mitigation. LULUCF-related actions represent about 25 percent of the emission reductions pledged by countries in their nationally determined contributions under the Paris Agreement (Grassi *et al.*, 2017). Roe *et al.* (2021) estimated the short-term cost-effective mitigation potential of forests and other ecosystems at 6.6 ± 2.9 $GtCO_2$ equivalent per year between 2020 and 2050.

This indicator measures progress towards SDG 13 and UNSPF 2017–2030 targets 1.2 and 2.5 and is relevant to measuring, reporting and verification requirements under the UNFCCC.

Tier. This is a tier 2 indicator.

DATA

Description. This indicator has various data sources. Developed countries report national historical anthropogenic LULUCF GHG emissions and removals as part of the LULUCF component of national GHG inventories (GHGIs) or in biennial reports and national communications, which are submitted periodically to the UNFCCC. Developing countries report on LULUCF in their GHGI sections in national communications or biennial update reports. From 2024, countries are expected to report through biennial transparency reports.

Historical emissions from LULUCF at the global level are based on bookkeeping models in the global carbon budget (Friedlingstein *et al.*, 2021; IPCC, 2019, 2021). Scenarios and pathways of future emissions from LULUCF at the global level are based on integrated assessment models (IAMs) (IPCC, 2018, 2021).

Significant discrepancies exist between country-reported net emissions/removals (i.e. those obtained via GHGIs) for LULUCF and estimates generated by IAMs, largely because of differing definitions of "anthropogenic"; compared with IAMs, GHGIs include a considerably larger volume of removals from forests deemed to be anthropogenic. Grassi *et al.* (2021) found the difference between national GHGIs and IAMs to be as large as 5.5 $GtCO_2$ per year.

Status and trends. Data from Friedlingstein *et al.* (2021) show that global CO_2 emissions from LULUCF decreased slightly in the two decades to 2020.

Near-constant gross emissions from LULUCF estimated at 14 ± 2 $GtCO_2$ per year in the period 2011–2020 were offset only partly by carbon removals on managed land of 10 ± 1.5 $GtCO_2$ per year, resulting in net emissions from managed land of 4.1 ± 2.6 $GtCO_2$, or about 10 percent of total anthropogenic CO_2 emissions, per year over the period.

Net emissions are estimated to have declined from 4.1 $GtCO_2$ per year in 2011–2020 to 2.9 $GtCO_2$ per year in 2021. Non-CO_2 emissions from LULUCF are mostly associated with fire and peatlands (Smith *et al.*, 2014) and comprise about 10 percent of total LULUCF emissions (in CO2 equivalent) (Jia *et al.*, 2019). Gross emissions from LULUCF are 2–3 times higher than net emissions (IPCC, 2021).

CHALLENGES AND LIMITATIONS

LULUCF emissions are the most uncertain component of the global carbon budget – estimates for 2020 come with an uncertainty measure of ± 78 percent. The convergence of different emission estimates does not reflect the high uncertainties in land-use-change datasets, which likely underestimate interannual variability and the (rising) importance of forest degradation, suggesting a need for more-accurate land-use data.

The next most uncertain component of the global carbon budget after LULUCF emissions is the land sink (mostly forests), where the uncertainty is assessed at ± 34 percent. Differing definitions, especially of what is considered anthropogenic, make it hard to compare estimates from different sources, and differences in methodology pose additional challenges; therefore, caution is advised in drawing conclusions from such comparisons.

GCS
4
TIER 1

Proportion of forest area within legally established protected areas

CONCEPTS AND DEFINITIONS

This indicator measures the proportion of forest area in formally established protected areas, regardless of the purpose for which the protected areas were established. It:

- includes IUCN categories I–IV; and
- excludes IUCN categories V–VI.

This is one of the subindicators of SDG indicator 15.2.1, for which FAO is the custodian agency.

RATIONALE/SCOPE

A single measure such as the proportion of forest area in legally established protected areas is insufficient for monitoring SFM as a whole (see GCS 2 for a definition of SFM). Therefore, this indicator is one of five SDG 15.2.1 subindicators for measuring progress in all dimensions of SFM.

Change in forest area in legally protected areas is a proxy for trends in the conservation of forest

biodiversity and the cultural and spiritual values of forests and thus a sign of the political will for protecting and conserving forests.

This indicator measures progress towards SDG target 15.2, UNSPF 2017–2030 target 1.1 and the post-2020 global biodiversity framework.

Tier. This is a tier 1 indicator.

DATA

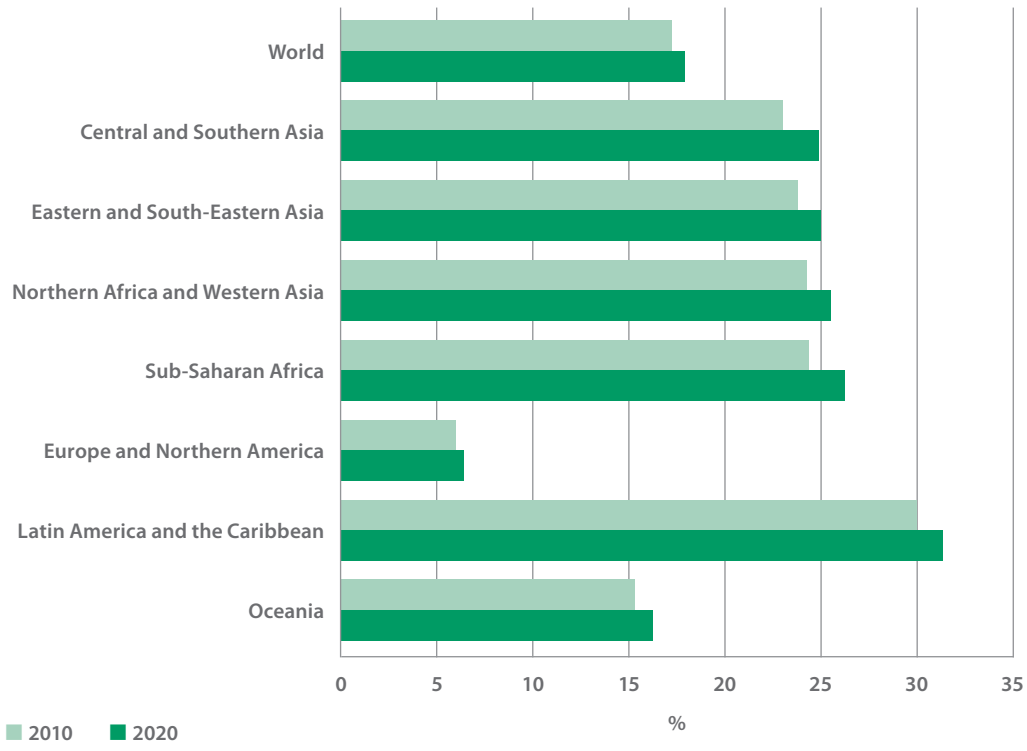
Description. FAO collects data on this indicator through the FRA, which has been conducted at regular intervals since 1946 and is now produced every five years. The latest assessment, FRA 2020, contains forest-area data for protected areas for 129 countries and territories, accounting for 84 percent of the global forest area, for 1990, 2000, 2010, 2015, 2016, 2017, 2018, 2019 and 2020 (an additional 41 countries provided data for some of these years). The next update of the FRA dataset is scheduled for 2025.

Status and trends. FRA 2020 reported that 18 percent of the world's forest area (726 million ha) is in legally established protected areas such as national parks, conservation areas and game reserves (IUCN categories I–IV). Of the seven regions shown in Figure 3, Latin America and the Caribbean has the highest share of forests in protected areas, at 31 percent, followed by sub-Saharan Africa (26 percent) and Northern Africa and Western Asia (25 percent). The area of forests in protected areas globally has increased by 191 million ha since 1990, but the rate of annual increase slowed in 2010–2020.

CHALLENGES AND LIMITATIONS

Trends are calculated using only those countries with complete time series of data. FRA's current five-year cycle means it is not presently possible to produce annual updates for this indicator. The potential for more frequent voluntary reporting to the FRA by countries on key indicators is being evaluated.

Figure 3. *Proportion of forest area in legally established protected areas, globally and by region, 2010 and 2020*



Source: FAO. 2021. *Tracking progress on food and agriculture-related SDG indicators 2021 – A report on the indicators under FAO custodianship.* Rome.

GCS
5
TIER 1

Change in area of primary forests

CONCEPTS AND DEFINITIONS

"Primary forest" is naturally regenerated forest of native tree species, where there are no clearly visible indications of human activities and the ecological processes are not significantly disturbed.

RATIONALE/SCOPE

The conservation of biodiversity allows species to survive, evolve and dynamically adapt to changing environmental conditions. It also enhances plant and animal gene pools and provides genetic reservoirs for tree breeding. Maintaining biodiversity is crucial for the long-term health and productivity of the world's forests. Primary forests – especially primary tropical moist forests – are species-rich, diverse ecosystems, and their extent is an important environmental indicator.

This indicator measures progress towards SDG 15.3, UNSPF 2017–2030 target 1.3 and a potential target in the CBD's post-2020 biodiversity framework (under ecosystem and habitats).

Tier. This is a tier 1 indicator.

DATA

Description. Data on primary forests are collected by FAO through the FRA (see GCS 1 for a description of the FRA process). The most recent assessment (FRA 2020) contains data on primary forests for 1990, 2000, 2010, 2015 and 2020.

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Status and trends. FRA 2020 received information on the area of primary forest in 2020 from 146 countries and territories representing 81 percent of the world's forest area. Based on the provided data, the area of primary forests worldwide in 2020 is estimated at 1.11 billion ha, or about one-third (34 percent) of the forest area of reporting countries.

Data on trends in the area of primary forest were obtained from 137 countries and territories representing 57 percent of the world's forest area.

Globally, the area of primary forest decreased by 81.3 million ha between 1990 and 2020. The average annual rate of loss was -3.41 million ha in 1990–2000 and -3.45 million ha in 2000–2010; the annual rate of loss dropped substantially in the most recent decade (2010–2020), to -1.27 million ha (Table 2).

The highest rate of loss between 2010 and 2020 was in Western and Central Africa (with the area of primary forest declining from 97 million ha to 88 million ha), followed by South America (down from 301 million ha to 298 million ha).

CHALLENGES AND LIMITATIONS

The low number of countries and territories reporting on trends in this parameter, and the use of proxies such as the area of forest in protected areas and other types of forest reserve, reduces the reliability of the trend analysis, and the findings here should be treated with caution. Moreover, the data do not indicate whether decreases in the area of primary forest are due to deforestation or to conversion to another forest type (such as naturally regenerating or planted forest).

FAO has initiated a study involving regional workshops aimed at enhancing the consistency, comparability, completeness and overall quality of data for this indicator. The guidelines and other tools for reporting on primary forest area and its changes developed through the study are expected to be ready for use in data collection for FRA 2025.

Table 2. *Area of primary forest and annual change, by region and subregion, 1990–2020*

REGION/ SUBREGION	DATA AVAILABILITY		PRIMARY FOREST (1 000 ha)				ANNUAL CHANGE (1 000 ha)		
	NO. OF REPORTING COUNTRIES	% OF FOREST AREA	1990	2000	2010	2020	1990–2000	2000–2010	2010–2020
Eastern and Southern Africa	9	27	34 179	33 591	32 849	32 669	-59	-74	-18
Northern Africa	5	77	1 650	1 528	1 406	1 284	-12	-12	-12
Western and Central Africa	16	72	107 463	102 063	97 075	88 891	-540	-499	-818
Africa	**30**	**51**	**143 291**	**137 182**	**131 329**	**122 843**	**-611**	**-585**	**-849**
East Asia	3	95	15 410	15 507	16 223	16 799	10	72	58
South and Southeast Asia	11	85	82 716	75 109	67 682	66 825	-761	-743	-86
Western and Central Asia	18	95	2 139	2 156	2 173	2 241	2	2	7
Asia	**32**	**90**	**100 265**	**92 772**	**86 078**	**85 866**	**-749**	**-669**	**-21**
Europe*	**35**	**44**	**853**	**988**	**1 319**	**1 406**	**14**	**33**	**9**
Caribbean	13	67	192	190	187	184	0	0	0
Central America	1	16	878	778	689	658	-10	-9	-3
North America	4	100	315 701	312 652	313 113	312 471	-305	46	-64
North and Central America	**18**	**97**	**316 772**	**313 621**	**313 989**	**313 313**	**-315**	**37**	**-68**
Oceania	**14**	**7**	**2 748**	**2 774**	**2 801**	**2 617**	**3**	**3**	**-18**
South America	**8**	**72**	**342 109**	**324 607**	**301 926**	**298 698**	**-1 750**	**-2 268**	**-323**
World	**137**	**57**	**906 038**	**871 944**	**837 442**	**824 742**	**-3 409**	**-3 450**	**-1 270**

*Note: * Excluding the Russian Federation.*

Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

GCS
6
TIER 2

Proportion of forest area disturbed

CONCEPTS AND DEFINITIONS

"Disturbance" is defined here as damage caused by any factor (biotic or abiotic) that adversely affects the vigour and productivity of a forest and which is not a direct result of human activities. This indicator encompasses the area affected by wildfire.

RATIONALE/SCOPE

Forests are subject to many disturbances that can adversely affect their health and vitality, reduce their capacity to provide a full range of goods and services, and cause tree mortality. For FRA 2020, countries were requested to report on the forest area affected annually by disturbances caused by insects, diseases (bacteria, fungi, phytoplasma and viruses) and severe weather events (e.g. snow, storms and drought).

Countries reported on the total land area and the forest area affected by fire. Humans have used fire as a management tool for millennia to improve hunting conditions, favour plants used for food and fibre, clear vegetation for agriculture and grazing, facilitate travel, and control pests. Fires contribute to the maintenance of some ecosystems, such as savannahs. Less-frequent fires in temperate and boreal ecosystems help create habitat mosaics of various ages and stages of regeneration. Although some forest ecosystems depend on fire for their regeneration, however, others can be devastated by it. Disastrous wildfires are associated with extreme fire-danger conditions driven by meteorological factors such as a lack of precipitation, high wind speeds, low humidity and high temperatures. They continue to have significant impacts globally, including the loss of human lives, built assets, biodiversity, habitat, production and productivity; the degradation of landscapes; and the disruption of livelihoods.

This indicator measures progress towards UNSPF target 1.4.

Tier. This is a tier 2 indicator.

DATA

Description. Data on disturbances are collected by FAO through the FRA, with the most recent assessment (FRA 2020) containing annual data for the period 2000–2017. Reporting on the various categories of disturbance in FRA 2020 was exclusive and required that only the additional area of forest affected in a given year was reported (and not the cumulative total).

Status and trends. Sixty-two countries representing 52 percent of the world's forest area reported on the area of forest affected by insects in 2015 (the most recent year with relatively complete reporting). The total area affected was 30.2 million ha, which was 1.4 percent of the total forest area of the reporting countries (Table 3).

Fifty-one countries representing 42 percent of the total forest area reported data on the area of forest affected by disease in 2015. The total area so affected was 6.60 million ha, which was 0.4 percent of the forest area of the reporting countries (Table 4).

Forty-eight countries and territories representing 37 percent of the total forest area reported data on the area of forest affected by severe weather events (e.g. snow, storm, ice break and drought) in 2015. The total area affected was 3.83 million ha, which was 0.3 percent of the forest area of the reporting countries.

Thirty-six countries and territories accounting for 25 percent of the world's forest area reported complete time-series data for the forest area disturbed annually by insects in 2000–2017. Given the low reporting and limited representativeness of the sample, the analysis of trends was confined to 2002–2016, a period with a relatively high percentage of reporting. The average annual area affected

Table 3. *Forest area affected by insects, by region, 2015*

REGION	DATA AVAILABILITY		FOREST AFFECTED BY INSECTS	
	NO. OF REPORTING COUNTRIES	% OF TOTAL FOREST AREA	AREA (1 000 ha)	% OF FOREST AREA
Africa	6	7	436	1.0
Asia	11	47	8 743	3.0
Europe	30	95	524	0.1
North and Central America	9	98	20 381	2.7
Oceania	3	5	1	0.0
South America	3	7	130	0.2
World	**62**	**52**	**30 215**	**1.4**

Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

Table 4. *Forest area affected by disease, by region, 2015*

REGION	DATA AVAILABILITY		FOREST AFFECTED BY DISEASE	
	NO. OF REPORTING COUNTRIES	% OF TOTAL FOREST AREA	AREA (1 000 ha)	% OF FOREST AREA
Africa	4	6	301	0.8
Asia	5	38	1 409	0.6
Europe	32	96	821	0.1
North and Central America	4	50	3 751	1.0
Oceania	3	5	62	0.6
South America	3	7	259	0.4
World	**51**	**42**	**6 603**	**0.4**

Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

Table 5. *Forest area affected by fire, by region, 2015*

REGION	DATA AVAILABILITY		FOREST AFFECTED BY FIRE	
	NO. OF REPORTING COUNTRIES	% OF TOTAL FOREST AREA	AREA (1 000 ha)	% OF FOREST AREA
Africa	18	37	33 458	13.7
Asia	26	78	5 367	1.1
Europe	40	99	2 902	0.3
North and Central America	17	98	8 054	1.1
Oceania	8	97	14 780	8.3
South America	9	84	33 483	4.7
World	**118**	**83**	**98 043**	**2.9**

Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

by insects over the period was 29.1 million ha (in 44 countries representing 47 percent of the world's forest area). The lowest area affected in any year was 23.7 million ha in 2011 and the highest was 35.3 million ha in 2013.

Thirty countries and territories representing 24 percent of the forest area reported complete time-series data for the forest area affected by disease in 2000–2017. More comprehensive reporting was available for 2002–2017, with data provided by 33 countries representing 37 percent of the world's forest area. The average forest area affected by disease in reporting countries in 2002–2017 was 4.76 million ha, with a low of 2.18 million ha in 2002 and a high of 6.63 million ha in 2011.

Thirty-two countries and territories representing 24 percent of the world's forest area reported annual data on the area of forest affected by severe weather events in 2000–2017. The analysis presented here is for 2002–2015, with data for 37 countries and territories representing 33 percent of the world's forest area. The average forest area affected by severe weather events globally over the period was 5.96 million ha, with a high of 9.38 million ha in 2006 and a low of 2.79 million ha in 2015.

About 98 million ha of forest was affected by forest fire in 2015 (the latest year for which information was available); this was mainly in the tropical domain, where fire burnt about 3 percent of the forest area in 118 countries reporting on fires for that year (Table 5). More than two-thirds of the total forest area affected was in Africa and South America. Data on fire from FRA country reports were greatly underreported and insufficient to produce global statistics for the trend analysis; therefore, estimates have been calculated only as the proportion of burnt forest area by ecological domain.

CHALLENGES AND LIMITATIONS

Challenges in this indicator include a lack of data and a lack of reference levels for the forest area affected by disturbances, with few countries systematically collecting such information.

In terms of data collection, a limitation is the lack of harmonization in the monitoring of various types of disturbance, and another is the application of different thresholds by countries for what qualifies as disturbance for reporting.

Many countries still lack reliable forest fire-monitoring systems. Robust time-series data on the area of forest burnt are needed to better understand trends in wildland and forest fires. Systems for monitoring the area subject to fire could be a starting point for more intensive analyses, leading to appropriate intersections with other datasets such as forest cover and their validation at the country level in future FRAs.

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GCS
7
TIER 3

Area of degraded forest

CONCEPTS AND DEFINITIONS

The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services defines forest degradation as a reduction in the biomass, productivity or benefits of a forest (IPBES, 2018). IUCN defines degraded forest as a forest ecosystem that has lost its capacity to provide important goods and services to people and nature. Despite such definitions, there is no widely applied operational definition of degraded forest.

RATIONALE/SCOPE

Human activities, severe climatic events, fire, pests, diseases and other environmental disturbances may degrade forests and thereby reduce the provision of forest goods and services, biodiversity values, productivity and health. Forest degradation may also negatively affect other land uses (e.g. by causing a loss of downstream water quality) and cause GHG emissions. Monitoring changes in forest quality, therefore, is an essential part of SFM.

This indicator measures progress towards SDG 15.3, UNSPF 2017–2030 target 1.3 and a potential target in the post-2020 biodiversity framework under ecosystem and habitats.

Tier. This is a tier 3 indicator.

DATA

Description. FRA 2020 collected information on degraded forests by requesting countries to indicate whether they monitored forest degradation and, if so, to provide the definition of degraded forest they used and a brief description of the monitoring process and results.

Status and trends. Fifty-eight countries, representing 38 percent of the global forest area, reported that they monitored the area of degraded forest (Table 6). Almost one-third of the reporting countries were in Africa, with those countries representing 28 percent of the region's forest area. Reporting was most comprehensive in South America, where the reporting countries accounted for 79 percent of the forest area.

CHALLENGES AND LIMITATIONS

Countries use various definitions of degraded forest and it is infeasible, therefore, to aggregate and compare data on the area of degraded forest at the regional and global levels. Most definitions are based mainly on the presence of forest disturbances. Some countries specify the type of disturbance (mostly anthropogenic factors such as logging and fire) and others are more generic.

Table 6. *Number and forest area of countries reporting on forest degradation, by region, 2020*

REGION	NO. OF REPORTING COUNTRIES	FOREST AREA OF REPORTING COUNTRIES (1 000 ha)	% OF TOTAL FOREST AREA
Africa	18	178 226	28
Asia	16	271 887	44
Europe	7	18 063	2
North and Central America	6	383 297	51
Oceania	3	39 519	21
South America	8	663 849	79
World	**58**	**1 554 841**	**38**

Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

GCS
8
TIER 1

Aboveground biomass in forest

CONCEPTS AND DEFINITIONS

"Aboveground biomass" is defined as all biomass of living vegetation, both woody and herbaceous, above the soil, including stems, stumps, branches, bark, seeds and foliage.[f]

This is a subindicator of SDG indicator 15.2.1, for which FAO is the custodian agency.

RATIONALE/SCOPE

GCS 8 is one of five SDG subindicators selected to measure progress towards all dimensions of SFM. Changes in aboveground forest biomass stock indicate the balance between gains in biomass stock due to forest growth and losses due to wood removals, natural losses, fire, wind, pests and diseases. At the country level and over longer time frames, SFM would result in a biomass stock that is stable or increasing, and a long-term reduction of biomass stock per unit area would imply either unsustainable management and degradation or unexpected losses due to fire, wind, pests or disease.

This indicator measures progress towards SDG 15.2, UNSPF targets 1.2 and 2.5 and the post-2020 biodiversity framework. It is also relevant to the reporting of GHG inventories in the LULUCF sector.

Tier. This is a tier 1 indicator.

[f] Where forest understorey is a relatively small component of the aboveground biomass carbon pool, it is acceptable to exclude it, provided this is done in a consistent manner throughout the inventory time series.

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DATA

Description. FAO collects data on this indicator through the FRA.

Status and trends. FRA 2020 received information on forest biomass in 2020 from 193 countries representing 99 percent of the world's forests. For those countries that provided no data, biomass and dead wood were estimated by multiplying

subregional per-ha averages by forest area (as estimated for each point in the time series). The aboveground biomass in the world's forests was estimated at about 118 tonnes per ha in 2020, up from 117 tonnes per ha in 2010 (Figure 4). The highest aboveground biomass per ha was in regions with tropical forests – with the highest value in Latin America and the Caribbean, at 178 tonnes per ha.

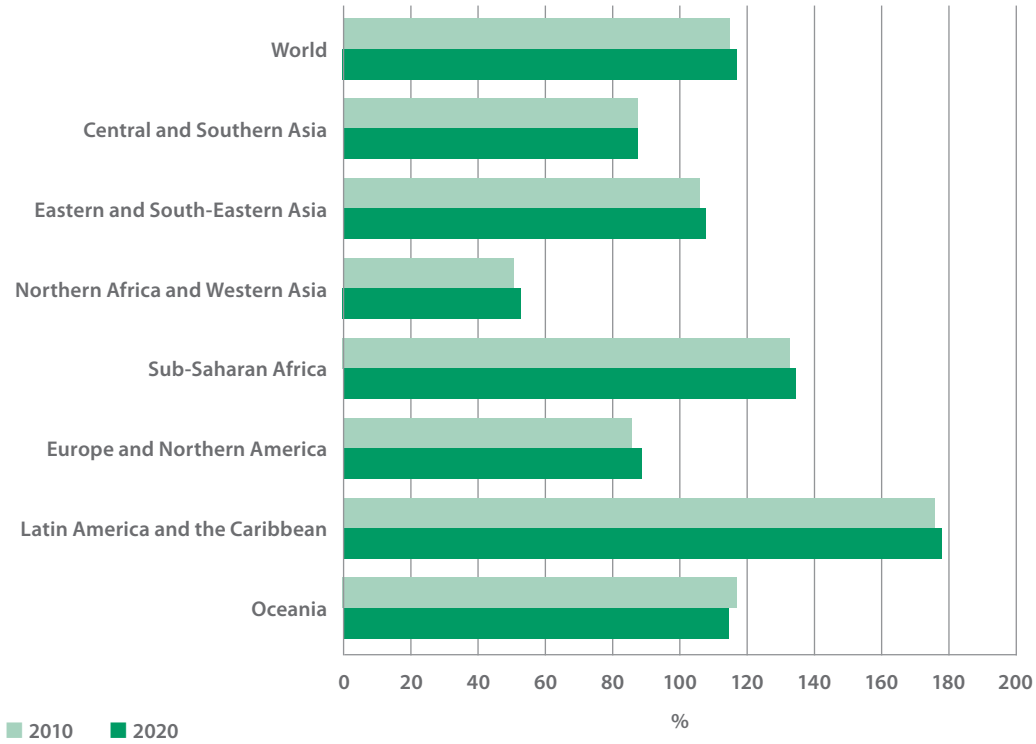
Many countries used the default conversion factors provided by the Intergovernmental Panel on Climate Change to estimate biomass from growing stock, although an increasing number of countries are developing estimates based on national data.

CHALLENGES AND LIMITATIONS

The current five-year cycle of the FRA means it is not presently possible to update this indicator annually. Trends can be calculated only for those countries with complete time series of data.

In many countries, assessments of forest area and biomass are carried out infrequently. The coverage of national forest inventories applied to assess forest biomass have improved considerably in the last ten years in many countries but remains limited and outdated in others; moreover, such inventories are often not repeated, thus not permitting trend assessments. The potential for more frequent voluntary reporting to the FRA by countries on key indicators is being evaluated.

Figure 4. *Total aboveground biomass in forest globally and by region, 2010 and 2020*



Source: FAO. 2021. *Tracking progress on food and agriculture-related SDG indicators 2021 – A report on the indicators under FAO custodianship*. Rome.

GCS
9
TIER 1

Volume of wood removals

CONCEPTS AND DEFINITIONS

The volume of wood removals in a country comprises the volume of all living and dead trees that are felled and removed from forests and other wooded lands and felling sites. It includes unsold roundwood stored at forest roadsides, natural losses that are recovered (i.e. harvested), removals during the year of wood felled in earlier periods, removals of non-stem wood such as stumps and branches (where these are harvested), and removals of trees killed or damaged by natural causes (e.g. fire, wind, insects and diseases) (i.e. natural losses). The definition comprises removals from all sources within a country, including public, private and informal. It excludes bark and other non-woody biomass and any wood that is not removed (e.g. stumps, branches and tree tops, where these are not harvested) and felling residues (harvesting waste). The parameter is reported in cubic metres of solid volume underbark (i.e. excluding bark). Where it is measured overbark (i.e. including bark), the volume must be adjusted downward to convert to an underbark estimate (Anonymous, undated).

RATIONALE/SCOPE

The tracking of industrial roundwood and woodfuel removals provides an approximation of how much wood from a forest goes to meeting needs for wood for construction, furniture, biofuel, paper and other products and how this demand is changing. Most

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of the world's wood comes from production and multiple-use forests, although, for some countries, other wooded lands and trees outside forests are important sources. Analyses of trends in wood demand and the types of forest that supply timber and woodfuel help show the importance of these forests for the long-term security of wood supplies.

This indicator measures progress towards UNSPF 2017–2030 target 2.4.

Tier. This is a tier 1 indicator.

DATA

Description. The volume of wood removed from forests is an indicator of the economic and social roles of forest resources in national economies and dependent local communities. In most countries, revenue from harvested wood is the single-largest income source from forests. Information on wood

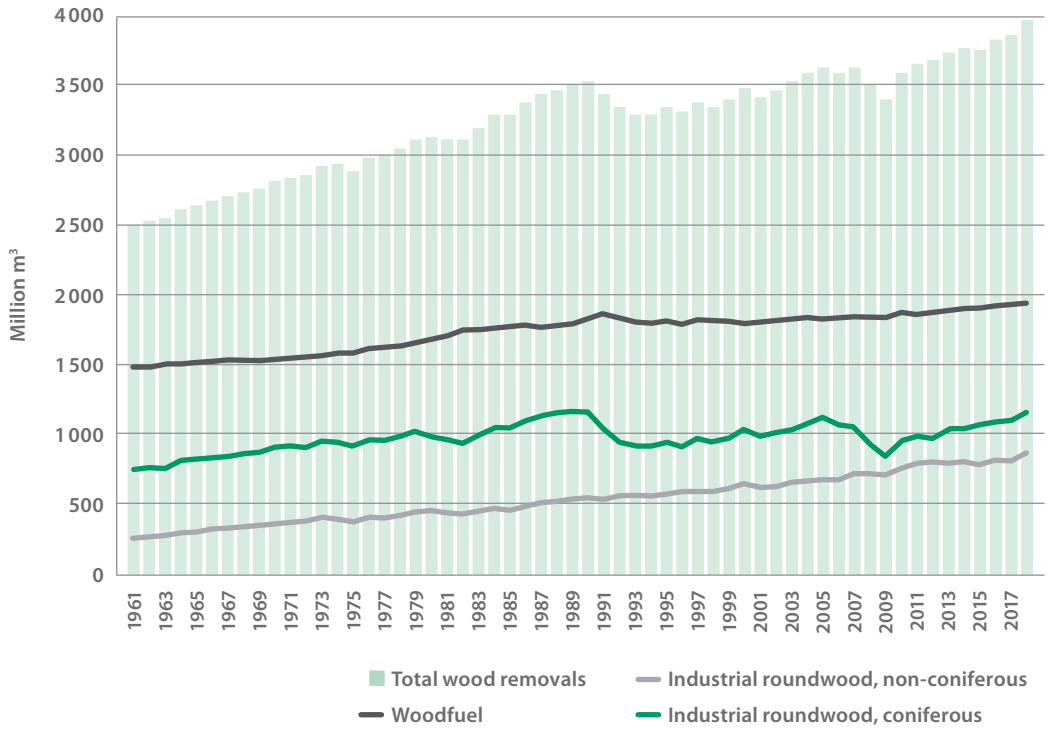
removals also helps in monitoring the use of forest and tree resources by comparing actual removals with the sustainable potential. International data on production, imports and exports are obtained from FAO. Data are collected via the Joint Forest Sector Questionnaire issued by FAO, Eurostat, FAO, ITTO and the United Nations Economic Commission for Europe (UNECE) and published in the FAOSTAT database. Data on apparent consumption are calculated as production plus imports less exports.

Status and trends. Data on wood removals were requested from countries for FRAs published in 2005, 2010 and 2015. In 2020, data on removals were obtained from the FAOSTAT database to reduce the reporting burden on countries. Global wood removals were estimated at 3.97 billion m^3 in 2018, of which about half was industrial roundwood and the other half woodfuel. This amount includes removals from forests, other wooded land and trees outside forests. This was a 10 percent increase from 2010, when the volume of wood removals was estimated at 3.59 billion m^3 (Figure 5). There were significant differences among the regions in the percentage of the wood harvest used as woodfuel, ranging from 90 percent in Africa and 62 percent in Asia to less than 25 percent in Europe, North America and Oceania (removals were roughly even for woodfuel and industrial roundwood in South America). The top ten countries for wood removals in 2018, led by the United States of America, accounted for 55 percent of total global removals (Figure 6).

Wood removals have increased steadily in Africa, from 506 million m^3 in 1990 to 779 million m^3 in 2018. The average annual growth of 2 percent in wood removals in Africa over the period was in line with population growth. Removals increased for both industrial roundwood and woodfuel.

In Asia, wood removals were roughly steady between 1990 and 2018, with the supply of industrial roundwood increasing and woodfuel removals declining correspondingly. This trend was influenced by the rapid development of forest-based industries in the region (i.e. increasing demand for industrial roundwood) and growing living standards (which

Figure 5. *Global trends in wood removals, 1961–2018*



Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

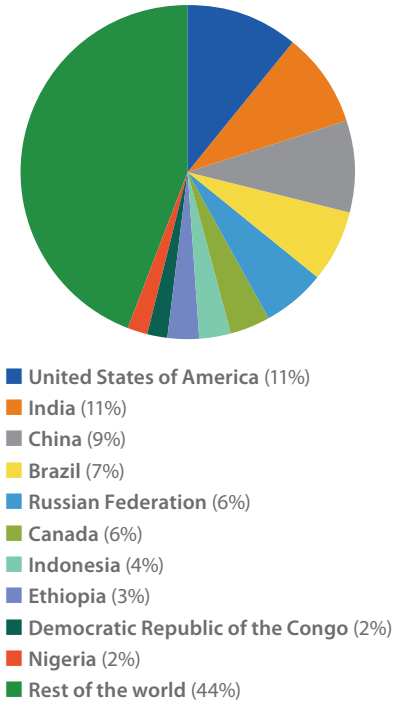
reduced demand for woodfuel as alternative energy sources became available), particularly in Eastern and South-Eastern Asia.

A sharp decline in removals in the Russian Federation in the early 1990s – a result of the transition from a centrally planned to a market-based economy – caused an overall reduction in removals in Europe of 21 percent between 1990 and 2000. Thereafter, however, removals in Europe moved back up, reaching a record 824 million m^3 in 2018, 3 percent higher than in 1990.

Removals in Northern America and the Caribbean were reasonably steady in the 1990s but declined sharply in the 2000s due to the 2008–2009 global financial crisis, which had negative impacts on the housing sector and consequently on wood demand, especially in Canada and the United States of America. Total removals in the region decreased from 761 million m^3 in 2000 to 613 million m^3 in 2010 before rebounding – in line with economic recovery – to 691 million m^3 in 2018. In addition to increasing removals of industrial roundwood, woodfuel removals have been growing in the region to meet increasing export demand for wood pellets.

There has been a steady increase in removals in Oceania in recent decades. Four countries (Australia, New Zealand, Papua New Guinea and the Solomon Islands) account for most of the region's wood removals, which doubled from 43 million m^3 in 1990 to 87 million m^3 in 2018, due largely to increased wood supply from forest plantations in Australia and New Zealand. Annual wood removals in South America also grew steadily between 1990 and 2018, from 272 million m^3 to 429 million m^3. Similarly to Oceania, a growing supply of industrial roundwood from forest plantations (especially in Argentina, Brazil, Chile and Uruguay) accounted for most of the increase. Overall, wood removals are increasing globally as demand for, and the consumption of, wood products escalates in line with the growth of populations and incomes. This trend is expected to continue in coming decades. Not all wood removals originate in forests, and the volume of wood removals in 2018 was less than 1 percent of the forest growing stock. Most of the long-term growth in wood supply is occurring in countries that have established forest plantations in recent decades (especially in Asia, Latin America and Oceania). Removals in Europe have increased significantly since 2000, particularly in Eastern Europe (including the Russian Federation), where forest industries and demand for wood are expanding rapidly.

Figure 6. *Top ten countries for wood removals, 2018*



Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

CHALLENGES AND LIMITATIONS

A large proportion of wood removals comes from other wooded land, trees outside forests and forests designated for other purposes. In developing nations, for example, two-thirds of woodfuel is derived from trees outside forests. These resources are often overlooked and undervalued and are not regularly included in national inventories; thus, data on the extent and structure of trees outside forests are often scarce, despite their increasing importance. It will be essential to increase the provision of accurate data on trees outside forests to ensure reliable information on wood volume stocks in the future (Thomas *et al.*, 2021).

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GCS
10
TIER 2

Share of wood-based energy in total final energy consumption

CONCEPTS AND DEFINITIONS

Wood energy is the energy generated from wood or wood-derived products – usually through combustion processes – and used primarily for cooking, heating or electricity generation. It includes wood sourced from forests, non-forest land, byproducts from wood-processing industries, and post-consumer recovered wood (FAO, undated[a]). The share of wood-based energy in total final energy consumption is the ratio of the final consumption of energy derived from wood and the total final energy consumption, inclusive of energy from renewable (e.g. woodfuel) and non-renewable (e.g. fossil fuel) sources. The indicator is measured as a percentage and composed of the following two parameters:

1. wood-energy consumption (country level); and
2. total final energy consumption (country level).

RATIONALE/SCOPE

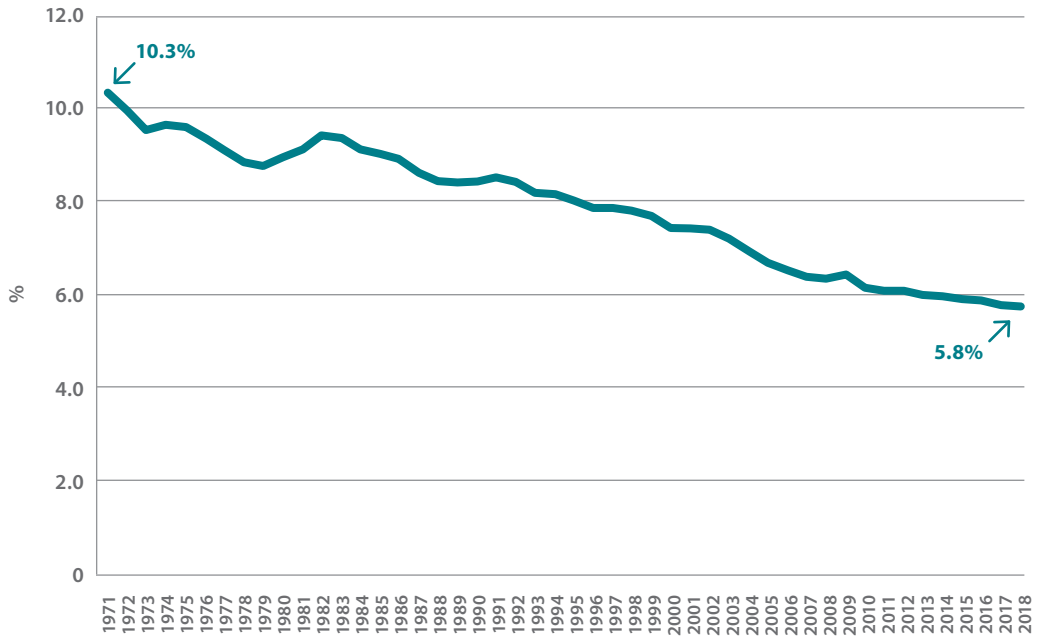
As the world's single largest source of renewable energy, wood energy is equally important for SDG 7 ("ensure access to affordable, reliable, sustainable and modern energy for all", especially SDG 7.2) and SDG 15.2 ("promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally") (Whiteman, 2017).

Tier. This is a tier 2 indicator.

DATA

Description. The main international organizations responsible for wood-energy data collection at the regional to global scale under their respective mandates are FAO, the UNECE/FAO Forestry and Timber Section, the International Renewable Energy Agency (IRENA), the United Nations

Figure 7. *Share of wood energy in total final energy consumption, 1971–2018*



Sources: FAO. Undated[b]. FAOSTAT [online]. [Cited 27 December 2021]; IEA. 2020. *Key World Energy Statistics 2020.* International Energy Agency (IEA).

Statistics Division (UNSD) and the International Energy Agency (IEA)/Eurostat/UNECE. FAO and UNECE generate global forest product statistics (including on woodfuel and wood charcoal) and IRENA, UNSD and IEA/Eurostat/UNECE contribute to energy statistics (national energy balances and commodity balances) (FAO, 2017; Glasenapp and McCusker, 2018; IRENA, 2018; IEA, 2020; UNECE, undated; UNSD, undated).

Status and trends. The share of wood energy in total final energy consumption can be calculated[g] using data on wood energy in FAOSTAT and data on total final energy consumption published by the IEA. The earliest and latest years for which data for both parameters are available are 1971 and 2018, respectively. The share has declined in the past 50 years, from 10.3 percent in 1971 to 5.8 percent in 2018 (Figure 7).

[g] The calculations presented here are based on the following assumptions: the consumption of woodfuel in a given year equals the production of woodfuel in a given year (i.e. without cross-year stock change); woodfuel imports and exports need to be considered at the country level; electricity and heat generated with woodfuel are not considered; and total final energy consumption excludes non-energy use.

CHALLENGES AND LIMITATIONS

Close collaboration in the production of statistics on forest products and wood energy is needed to generate good-quality data on wood energy. The biggest challenges associated with this indicator are the availability and quality of wood-energy data that are collected unsystematically; differences in data-collection methods and data structure between forestry and energy statistics; and difficulties in determining the amount of "traditional use" of wood energy by households and rural enterprises (i.e. self-collection for self-use or informal trade).

Data quality for this indicator may benefit from an assessment of data consistency and coherence across agencies and improvement of these; inclusive dialogue bringing together experts on forest products, forest resources and energy statistics; an evaluation of existing models for estimating woodfuel production and consumption where data are missing; and capacity development at the country level to increase data availability and quality.

GCS
11
TIER 1

Forest area with a designated management objective to maintain and enhance its protective functions

CONCEPTS AND DEFINITIONS

This indicator reports the total area managed for the protection of soil and water and for biodiversity conservation. Note that management objectives are not necessarily exclusive and areas, therefore, may be counted more than once. For example, forest areas for which the management objective is "multiple use" should be counted once for each specific management objective within the multiple-use category; and forest areas with a primary management objective can be counted more than once if other management objectives are specified.

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RATIONALE/SCOPE

FRA 2020 identified six broad forest management objectives:

1. Production – the management objective is the production of timber, fibre, bioenergy and/or non-wood forest products.
2. Protection of soils and water – the management objective is the protection of soils and water.
3. Conservation of biodiversity – the management objective is biodiversity conservation. This category includes but is not limited to areas designated for biodiversity conservation in protected areas.
4. Social services – the management objective is the provision of social services such as recreation, tourism, education, research and the conservation of cultural or spiritual sites.
5. Multiple use – the management objective is a combination of several purposes, none of which is significantly more important than another. Thus, a designation of multiple use indicates that the forest is managed for any combination of production, soil and water protection, biodiversity conservation and the provision of social services.

6. Other – the management objective is other than production, the protection of soils and water, biodiversity conservation, social services and multiple use.

One of the most important protective functions of forests is related to soil and water resources. Forests conserve water by increasing infiltration and reducing runoff velocity, surface erosion and sedimentation (the latter is particularly relevant behind dams and in irrigation systems). Forests play a role in filtering water pollutants, regulating water yield and flow, moderating floods, enhancing precipitation (e.g. cloud forests capture moisture from clouds) and mitigating salinity.

In addition to the primary designated management objective, FRA 2020 collected information on the area of forest in protected areas and under long-term management plans. The area and proportion of forests under formal protection is an indicator of how countries are addressing the need to conserve and protect forest ecosystems and the services those ecosystems provide.

This indicator measures progress towards UNSPF 2017–2030 target 1.4.

Tier. This is a tier 1 indicator.

DATA

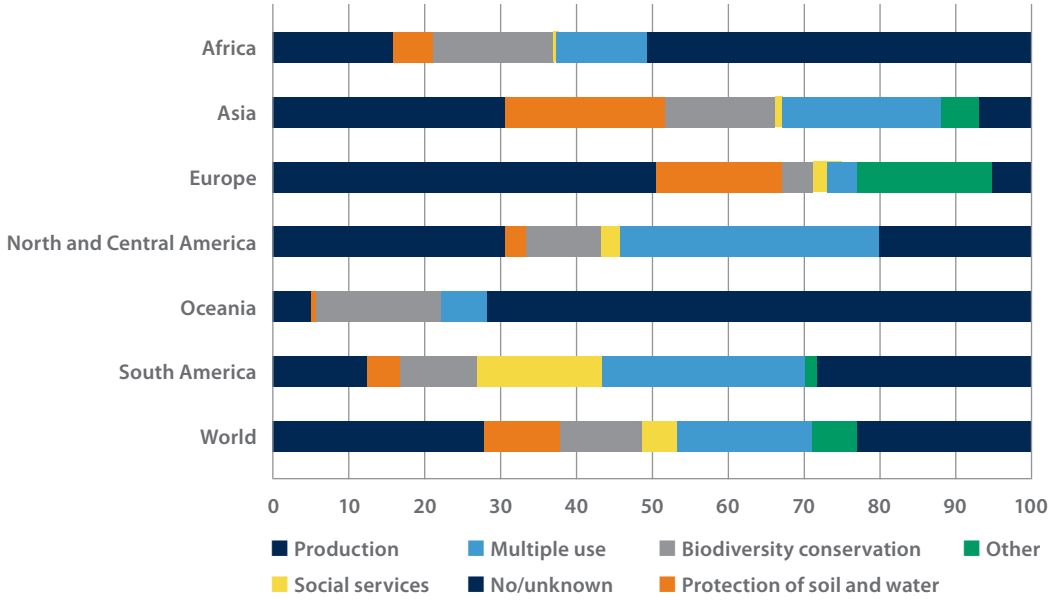
Description. Data on forest area primarily designated for the protection of soils and water and for biodiversity conservation are collected by FAO through the FRA. The most recent assessment (FRA 2020) contains data for these indicators for 1990, 2000, 2010, 2015 and 2020.

Status and trends. Figure 8 shows the proportion of the total forest area (globally and by region) designated for various primary management objectives in 2020.

FRA 2020 received information on the area of forest designated primarily for the protection of soils and water in 2020 from 141 countries and territories representing 82 percent of the world's forest area. The area of forest so designated is estimated at 398 million ha, which is 12 percent of the total forest area of the reporting countries and territories. Europe has the largest area of forest designated primarily for soil and water protection, at 171 million ha (18 percent of the region's total forest area), followed by Asia, at 132 million ha (22 percent – the largest proportion of any region).

FRA 2020 received time-series data on the area of forest designated primarily for soil and water

Figure 8. *Proportion of the total forest area designated for various primary management objectives, by region and globally, 2020*



Source: FAO. 2020. *Global Forest Resources Assessment 2020 – Main report*. Rome.

protection from 131 countries representing 71 percent of the total forest area. The area of forest so designated in these countries increased by 119 million ha between 1990 and 2020.

FRA 2020 received information on the area of forest designated primarily for the conservation of biodiversity in 2020 from 165 countries and territories representing 91 percent of the world's forest area. The area of forest so designated is estimated at 424 million ha, which is 11 percent of the total forest area of the reporting countries and territories. The largest area of forest designated for biodiversity conservation is in Africa, at 107 million ha; this is 24 percent of the forest area, which is also the highest proportion among the regions. The lowest proportion is in Europe, at 4 percent, although this increases to 12 percent if the Russian Federation is excluded.

FRA 2020 received time-series data on the area of forest designated primarily for biodiversity conservation from 161 countries and territories representing 91 percent of the total forest area. The area of forest so designated increased by 111 million ha between 1990 and 2020, with the largest increase occurring between 2000 and 2010.

CHALLENGES AND LIMITATIONS

Countries were asked to report to FRA 2020 on the status of, and trends in, their forests according to the primary designated management objective – that is, the main intended purpose for which a forest is managed and used. To be considered "primary", the management objective must be significantly more important than other management objectives, and the forest area reported under a given primary management objective may not be reported under any other primary management objective. Note, however, that the primary management objective does not exclude the provision of other benefits or values. For example, sustainably managed natural production forests – for which the primary objective might be wood production – typically also contribute to the protection of soils and water, biodiversity conservation, and the provision of social services. Hence the figures for "protective functions" presented here are systematic underestimates. Similarly, forests managed primarily for the protection of soils and water might also contribute to wood production, biodiversity conservation and other management objectives.

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GCS
12
TIER 2

Employment related to the forest sector

CONCEPTS AND DEFINITIONS

International guidelines for the definition and measurement of employment are agreed on at the International Conference of Labour Statisticians (ICLS). In the context of the GCS, employment in the forest sector is proposed to be presented as a percentage of total employment in a given country. According to the FRA's definition (FAO, 2018), employment in forestry is reported in terms of full-time equivalent (FTE), which is defined as "a measurement equal to one person working full-time during a specified reference period" in which "one full-time employee counts as one FTE, and two half-time employees also count as one FTE". FTE is a measure of labour input commonly used in the measurement of productivity in national accounts.

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RATIONALE/SCOPE

Forests are important sources of employment, livelihoods and incomes globally. They contribute to the achievement of various SDGs relevant to employment and livelihoods and can play an important role in a green recovery in response to the COVID-19 pandemic. Employment is an indispensable component of SFM and its implementation.

This indicator measures progress towards UNSPF 2017–2030 target 2.4.

Tier. This is a tier 2 indicator, but the Expert Workshop on Strengthening the Global Core Set of Forest Indicators proposed that it be upgraded to tier 1 (Anonymous, 2020).

DATA

Description. Data providers for this indicator include FAO, the International Labour Organization (ILO) and others. For FAO, data collection is carried out as

Table 7. *Total employment in the forest sector, by region, 2011–2013 to 2017–2019*

REGION	NO. OF COUNTRIES	FORESTRY AND LOGGING		MANUFACTURE OF WOOD AND PRODUCTS OF WOOD		PULP AND PAPER MANUFACTURE		TOTAL FOREST SECTOR	
		2011–2013	2017–2019	2011–2013	2017–2019	2011–2013	2017–2019	2011–2013	2017–2019
		(1 000 PERSONS)							
Africa	54	1 928.3	1 972.7	1 866.2	2 361.4	316.9	418.2	4 111.4	4 752.3
Americas	33	819.5	842.1	1 445	1 291.7	637.2	689.4	2 901.7	2 823.2
Asia	48	5924	4 199.7	18 145	14 104.1	4 828.7	3 759.5	28 897.7	22 063.3
Europe	39	872.2	965.3	1 670.7	1 557.9	882.1	961.6	3425	3 484.8
Oceania	11	64.6	77.7	73.4	85.2	27.1	25.2	165.1	188.1
Global	**185**	**9 608.6**	**8 057.5**	**23 200.3**	**19 400.3**	**6 692**	**5 853.9**	**39 500.9**	**33 311.7**

Note: Seventy-eight countries reported forestry employment data for at least one of the subsectors in the ILO Microdata Repository. For countries with missing data points, estimates are based on regional coefficients and employment figures from the ILO modelled estimates in broad sectors of agriculture and manufacturing.

Source: Lippe, R.S., Shannon, C. & Schweinle, J. Forthcoming. *Contribution of the forest sector to total employment in national economies*. Rome, FAO.

part of the FRA. The ILO Department of Statistics harmonizes data from its labour-force surveys in the ILO Microdata Repository according to a set of common indicators, which includes actual hours worked in the forest sector (ILO, 2018). A number of other data sources, such as the 50×2030 Initiative to Close the Agricultural Data Gap and FAO's Agricultural Integrated Surveys Programme may also be used to collect information on employment in agriculture and specifically the forest sector.

Status and trends. Based on those countries for which data on employment in the forest sector are available in the ILO Microdata Repository and on modelled estimates derived from the agriculture and manufacturing sector to fill gaps for those countries lacking available data, the number of people employed in the forest sector globally in the period 2017–2019 is estimated at about 33 million, 80 percent of whom were in Asia and Africa (Table 7). Overall, there was a downward trend in forest-based employment over the decade to 2019, strongly influenced by the decreasing number of people employed in the wood-based manufacturing subsectors, particularly in Asia and Oceania.

Employment in the forest sector and all its subsectors has been declining as a percentage of total employment in all economic activities since 2011–2013 (Figure 9).

Observed trends reveal moderate differences between regions and subsectors. In the forestry and logging subsector, the share of employment decreased slightly in all regions except Oceania and Europe, where there was a small overall increase between 2011–2013 and 2017–2019) (Figure 9a). In the wood industry subsector, there was a downward trend in Asia, particularly between 2014–2016 and 2017–2019, and a slightly upward trend in the same period in Europe (Figure 9b). There was little change in the share of employment held by the pulp-and-paper industry in most regions over the period (Figure 9c), with the exception of Africa and Europe, where there were slight increases in employment share between 2014–2016 and 2017–2019 (Lippe, Shannon and Schweinle, forthcoming).

CHALLENGES AND LIMITATIONS

Forest employment data calculated using a harmonized methodology have only limited coverage. Standardizing data collection would, among other things, require using the concept and definition of employment adopted in a resolution of the nineteenth ICLS in 2013 (ILO, 2013), but the majority of countries still use the definition of the thirteenth ICLS (ILO, 1982). Overall, employment in the forest sector may be underestimated due to various

factors, some of which relate to the seasonality of certain forest-related work.

Data availability for this indicator could be improved by the consistent use of the definition of employment given here and its corresponding measurement in line with ICLS recommendations. Other possible actions include conducting a systematic review of data availability in ILOSTAT, including comparable sector-level data from other sector-specific sources; carrying out further work on the potential for using time-series estimates and projections to reduce data gaps; commissioning additional research to contribute to data-quality verification; and increasing support for countries in collecting, compiling and disseminating harmonized data related to this indicator in line with the SDG framework.

Figure 9. *Share of forest-related employment in total employment for all economic activities, by region and subsector, 2011–2013 to 2017–2018*

Note: d ("forest sector") is the aggregation of a, b and c.

Source: Lippe, R.S., Shannon, C. & Schweinle, J. Forthcoming. *Contribution of the forest sector to total employment in national economies*. Rome, FAO.

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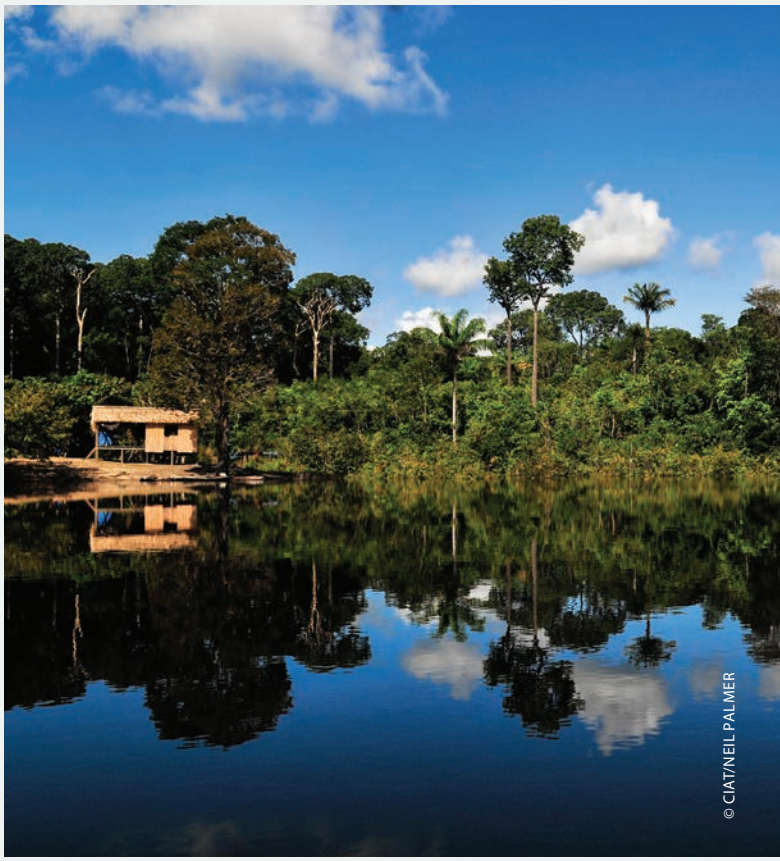
GCS
13
TIER 3

Number of forest-dependent people in extreme poverty

CONCEPTS AND DEFINITIONS

The term "forest-dependent people" is used widely to describe human populations that gain some form of benefit from forests (Byron and Arnold, 1999; Newton *et al.*, 2016). Nevertheless, the term is contested because the concept of dependency can encompass many dimensions, including dependence on forests for livelihoods and material products and others that are more difficult to quantify, such as sense of place and identity (Newton *et al.*, 2016). In low- and middle-income countries, the term forest-dependent people is often used to describe Indigenous Peoples and other traditional peoples and communities living in or close to forests and can also encompass urban populations relying on forest products (e.g. woodfuel). In high-income countries, the term might be used to describe people and communities that rely on forest-related industries (e.g. timber) for employment.

The term "forest-proximate people" refers to humans that live in or near forests (Newton *et al.*, 2020). Many definitions of forest-dependent people include criteria reflecting spatial relationships between people and forests, often with respect to Indigenous Peoples and other local people in rural areas in and around forests. This subset of forest-proximate people often derives direct subsistence or income-generating livelihood benefits from forests and is more likely to derive such benefits compared with those living more distantly from forests. Forest-proximate people are also the demographic often targeted by agencies tasked with poverty alleviation and sustainable socio-economic development in forested regions. Forest proximity, therefore, is often a necessary if insufficient criterion for measuring forest dependence and may be a useful proxy for it.



RATIONALE/SCOPE

This indicator is classified as a tier 3 indicator and requires additional methodological development. A key challenge is that its calculation relies on an agreed definition of forest dependency and two sequential analyses – the first to estimate the number of forest-dependent people and the second to compute a subset of forest-dependent people that are poor.

Due to conceptual and technical challenges in the operationalization and calculation of forest proximity, FAO collaborated with experts to develop a replicable methodology to estimate the number of forest-proximate people using publicly available, global-scale datasets (Newton *et al.*, 2022). The team is now exploring potential avenues for estimating the subset of forest-proximate people who are poor.

This indicator measures progress towards GFG 2 and its target 2.1.

Tier. This is a tier 3 indicator.

DATA

Description. Estimates of the number of forest-proximate people are influenced heavily by the datasets, definitions and parameters used in the analysis. A previous analysis (Newton *et al.*, 2020) estimated that there were 1.60 billion forest-proximate people in the world in 2012.

Building on the same approach (i.e. using a methodology that is conceptually similar to Newton *et al.* (2020) but with different datasets, definitions and parameters), Newton *et al.* (2022) estimated the number of forest-proximate people in 2019. The new methodology relies on spatial overlays that combine global-scale remotely sensed data on tree cover (as a proxy for forest cover) and gridded human population data to identify people living in or close to forests. This methodology is replicable using publicly available global-scale datasets and could form part of this indicator.

Estimating the subset of forest-proximate people who are poor requires the superimposition of poverty data. The most complete and highest-spatial-resolution dataset on poverty with global coverage is the World Bank's Global Subnational Atlas of Poverty, which mapped the 2018 poverty head-count ratio at USD 1.90 for about 1 800 administrative areas in 133 countries at subnational level 1 and for 33 countries at the national level.

Status and trends. Newton *et al.* (2022) estimated that 3.27 billion and 4.17 billion people lived within 1 km and 5 km, respectively, of a forest in 2019, representing 75 percent and 95 percent, respectively, of the total rural population. That is, the analysis found that a large majority of people living outside urban areas lived near a forest.

The operationalization of this indicator remains a technical challenge. FAO will continue working with the World Bank and forest experts such as Newton *et al.* to develop a proof of concept for the superimposition of data on poverty and forest proximity.

CHALLENGES AND LIMITATIONS

The forest-proximity concept needs to be refined, discussed and endorsed at the global level in light of the objective of this indicator and to enable countries to report regularly on it.

For its effective superimposition on forest-proximity data, poverty data would ideally be in the form of annual gridded data, with global coverage, using consistent measurement and estimation metrics, at a spatial scale that matches that of the forest and human population-density data (i.e. 100 m^2). Poverty data at this spatial resolution would take full advantage of the high spatial resolution of forest and population-density data; however, no such gridded poverty data yet exist at a global scale.

The generation of gridded poverty data is developing rapidly, and the field has taken significant strides in the last five years. The availability of new very-high-resolution satellite imagery in the public domain and its incorporation into geospatial analysis platforms (e.g. Google Earth Engine) holds promise for more detailed and accurate gridded poverty estimates. Several groups, including at the World Bank, are developing these methods.

GCS
14
TIER 3

Contribution of forests to food security and nutrition

CONCEPTS AND DEFINITIONS

Food security exists "when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (World Food Summit, 1996). The four pillars of food security and nutrition (FSN) are availability, access, utilization and stability: availability refers to the supply of food through production, distribution and exchange; access covers physical access (proximity), social access, economical access (affordability) and the consequent allocation of food; utilization refers to the metabolism of food by individuals and the factors needed for individuals to make use of the foods they have access to (including, for example, energy for cooking, clean water, sanitation and healthcare); and stability refers to the constancy and resilience of the other three pillars over time.

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RATIONALE/SCOPE

Forests, trees and agroforestry systems play key but often undervalued roles in supporting the four dimensions of FSN. They provide diverse and nutritious foods (such as nuts, oils, leaves, flowers, roots, fruit, wild meat, fish, herbs, saps, mushrooms, tubers and insects) and feed for livestock; bioenergy for cooking and boiling water; income and employment (both formal and informal); and ecosystem services such as water regulation and pollination that are indispensable for agriculture and food production.

This indicator measures progress towards GFG 2 and its target 2.3.

Tier. This is a tier 3 indicator.

DATA

Description. Data on the contributions of forests to FSN are not collected systematically by all countries and territories. As described above, forests, trees and agroforestry systems make diverse contributions to FSN, and encompassing these in a single indicator is challenging. This is exemplified by non-wood forest products (NWFPs), including foods, medicines, fodder, aromatic products, wild meat and honey. Measuring the FSN benefits of forests is complex

partly because of the diversity of NWFPs as well as other factors, such as the informality of much of the harvesting, processing and consumption that takes place.

FAO and CIFOR-ICRAF have developed the following five potential subindicators that could be estimated for this indicator using existing data:

1. **Employment provided by forests and trees** – initially, a proxy of this subindicator could be based on ILOSTAT data obtained from national labour-force surveys, household surveys and censuses and linked to GCS indicator 12.
2. **Consumption of woodfuel per capita** – this could be calculated at the national level based on FAOSTAT data (taking GCS 10 into account). It could also be refined over time to cover only woodfuel consumption from households (residential use) and only those households using wood as a source of energy. Population and agricultural censuses and agricultural and household surveys are means for collecting this type of information.
3. **Consumption of fruit (or only fruit from trees) per capita** – this subindicator could be calculated from FAOSTAT food-balance sheets. It would measure fruit consumption per capita (in kg per capita and per year).
4. **Consumption of nuts per capita** – this subindicator, calculated from FAOSTAT food-balance sheets, would measure nut consumption per capita (in kg per capita and per year).
5. **Percentage of farming households with part of their livelihoods derived from forests and trees** – this subindicator would measure the percentage of farming households benefiting from forests and trees. It would reflect the diverse contributions that forests and trees make to the livelihoods of farmers as sources of food and income. Many countries collect this type of information through agricultural censuses, agricultural and household surveys and household surveys in forestry.

Status and trends. Information on the contributions of forests, trees and agroforestry to FSN is unavailable for many countries and territories. FRA 2020 received information on NWFPs from 124 countries and territories representing 73 percent of the global forest area, with those constituting foods comprising almost half of all NWFPs reported. Edible plant products are of considerable importance in Africa, with 77 percent of reporting countries to FRA 2020 providing information on these. Edible plant products are also essential in other regions; for example, a vast diversity of such plants (e.g. nuts, fruit, vegetables and spices) are sold in Asia. In Europe, plant-based forest foods mainly comprise berries, nuts (pine nuts and chestnuts) and mushrooms.

CHALLENGES AND LIMITATIONS

Grouping the diverse contributions of forests, trees and agroforestry to FSN in a single indicator is challenging. The adoption of the subindicator approach described above, which aims to capture the multifaceted concept of FSN by including employment and wood energy covered in other GCS indicators, risks overlaps and increasing the reporting burden.

Most global statistical compilations and reporting on the production, trade and consumption of forest products focus on wood products, and data collection on NWFPs is rarely systematic, despite their considerable economic and social importance. There are two main reasons for this: NWFPs are essentially the domain of the informal sector; and NWFPs are highly diverse.

Developing a set of subindicators for assessing and monitoring the various contributions of forests, trees and agroforestry systems to FSN seems feasible. It may not be ideal, however, given the additional reporting burden it may impose on countries and the complexity it would add to the GCS.

GCS
15
TIER 3

Financial resources from all sources for the implementation of sustainable forest management

CONCEPTS AND DEFINITIONS

Ensuring sufficient financial resources for SFM are key to achieving SDG 15, and it is the focus of SDG target 15.b, "Mobilize significant resources from all sources and at all levels to finance sustainable forest management and provide adequate incentives to developing countries to advance such management, including for conservation and reforestation". There is no official or universal definition of the concept of financial resources for SFM. Building on work by Singer (2016), however, the concept may be defined as financial resources that contribute directly or indirectly, explicitly or implicitly, to the sustainable management of any type of forest and of trees outside forests.

RATIONALE/SCOPE

Forests address multiple global challenges and contribute to the sustainable development of all countries, even those without significant forest areas. Forests provide a wide range of goods and services that support human well-being and reduce poverty, assist long-term social and economic development, and reduce environmental risks and ecological scarcities. The livelihoods and subsistence of more than 1.6 billion people depend on forest goods and services. Wood, NWFPs and forest ecosystem services add significant value to the world economy and offer employment in rural areas. The provision of adequate and sustained financing for forests is essential for ensuring the continued supply of these products and services to societies and will also assist in reducing ecosystem degradation. Investments in forests can obtain safe long-term rates of return as well as multiple co-benefits for climate, biodiversity, soil and water protection, flood control, and employment for forest communities and Indigenous Peoples.

This indicator measures progress towards GFG 4 and its targets 4.1 and 4.2. There are linkages with SDG targets 15.a and 15.b.

Tier. This is a tier 3 indicator.

DATA

Description. Comprehensive global data on this indicator and its trends are currently unavailable.

Status and trends. Comprehensive global data on this indicator and its trends are currently unavailable.

CHALLENGES AND LIMITATIONS

The Organisation for Economic Co-operation and Development provides data on official development assistance for forestry through its Creditor Reporting System (OECD, undated); in general, however, reliable, comprehensive data on forest funding are unavailable. The lack of information is a major barrier to improved understanding of the true costs associated with the management of all types of forests and the potential of forests to contribute to sustainable development. Appropriate guidelines and templates could help countries report more clearly on forest financing, which also requires strengthening national technical and technological capacities.

GCS
16
TIER 1

Existence of national or subnational policies, strategies, legislation, regulations and institutions which explicitly encourage sustainable forest management

CONCEPTS AND DEFINITIONS

Policies, strategies, legislation and regulations that explicitly encourage SFM refer to and promote the multiple dimensions of forest and tree conservation and sustainable use.

RATIONALE/SCOPE

Many countries have developed policies and laws designed to promote the sustainable multipurpose use of forests and trees. These serve as a foundation for SFM by, for example, promoting legal timber trade, involving stakeholders in forest management, addressing forest tenure and providing incentives. This indicator measures progress towards GFG 5.

Tier. This is a tier 1 indicator.

DATA

Description. Data on policies and legislation are collected by FAO through the FRA. FRA 2020 contains information on the existence of policies and legislation.

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Status and trends. FRA 2020 received information on forest policies in 2020 from 187 countries and territories representing 99 percent of the total forest area. Of these, 164 countries and territories

(also representing about 99 percent of the total forest area) indicated that they have national forest policies. The large majority reported that they have national-level policy statements; only three countries reported that they have subnational statements but no national forest policy statement (or they did not report on the latter). Twenty-three countries reported that they had no forest policy statement. One hundred and seventy-two countries and territories representing 99 percent of the total forest area indicated that they have forest legislation. The other 64 countries and territories (representing 1 percent of the total forest area) did not report on this aspect or did not provide an affirmative response on the presence of forest legislation. All but one of the countries that responded in the affirmative (i.e. 171 countries) indicated that they have specific forest-targeted legislation at the national level.

CHALLENGES AND LIMITATIONS

The findings of FRA 2020 show that most countries – encompassing the large majority of the world's forests – have formalized the principles of SFM in forest-related policies and laws.

GCS
17
TIER 1

Existence of national or subnational forest assessment processes

CONCEPTS AND DEFINITIONS

No commonly agreed definition of forest assessment processes exists.

RATIONALE/SCOPE

This indicator measures progress towards UNSPF 2017–2030 target 4.5.

Tier. This is a tier 1 indicator.

DATA

Description. Nesha *et al.* (2021) assessed national forest monitoring capacities based on country reports submitted for FRA 2020. They applied a three-class tier system for data quality to a selection of core forest indicators: forest-area status, forest-area trend, growing-stock status, growing-stock trend, biomass, and carbon.

Status and trends. Data sources for more than 90 percent of the estimated forest-area status in 2020 can be categorized as tier 3 (highest reliability), with regional variations. This is a substantial improvement compared with FRA 2015 (FAO, ed., 2016), with the number of countries reporting tier 3 for forest-area status and trends almost doubling. Overall, data quality was greatly improved in FRA 2020 compared with FRA 2015 for all the selected indicators; this indicates that many countries produced new data and are considerably improving their monitoring and reporting on forests. Given the improvement in national-level data, regional and global aggregates are also more reliable than previously. On the other hand, most countries are still reporting on biomass using default factors, and there is room for improvement in estimates of trends, particularly in Africa.

CHALLENGES AND LIMITATIONS

Using a tiered approach for assessing data quality enables comparisons at different spatial and temporal scales. Nevertheless, the methodologies for data-gathering differ within and between jurisdictions, and the tiered approach may not capture these differences or the varying quality of the data they may produce.

Although they are the least accurate, the use of tier 1 data (as defined by Nesha *et al.*, 2021) enables countries with insufficient national data to estimate and report on various indicators; such countries should also be encouraged to improve measurement over time to achieve higher-level tiers of accuracy.

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GCS
18
TIER 1

Existence of national or subnational stakeholder platform for participation in forest policy development

CONCEPTS AND DEFINITIONS

A national stakeholder platform is a recognized procedure for enabling a broad range of stakeholders to provide opinions, suggestions, analysis, recommendations and other inputs into the development of national forest policies.

RATIONALE/SCOPE

Many countries still lack appropriate mechanisms for involving stakeholders in forest-related decision-making processes and supervision. Ensuring the participation and involvement of all stakeholders in forest governance, planning and development is an important element of SFM.

This indicator measures progress towards UNSPF 2017–2030 target 4.5.

Tier. This is a tier 1 indicator.

DATA

Description. FRA 2020 collected data on the existence of national or subnational platforms that promote or allow stakeholder participation in forest policy development.

Status and trends. A total of 142 countries and territories representing 95 percent of the total forest area reported to FRA 2020 that they have platforms to enable the participation of stakeholders in forest policy development; 40 countries and territories indicated that they do not have such a platform and 54 did not report. Of the 142 countries and territories with platforms, 44 are in Africa, 29 are in Asia, 32 are in Europe and 17 are in North and Central America, and there are ten each in Oceania and South America. Only three countries (all in Europe) reported having subnational rather than national platforms to enable stakeholder participation in forest policy development.

CHALLENGES AND LIMITATIONS

There is little agreement among decision-makers on how to include forest values in systems of measurable goals, criteria and indicators (Agnoletti, 2008; Boström, 2012; Chan, Satterfield and Goldstein, 2012).

FRA 2020 initiated an online platform to facilitate the reporting and dissemination of results to end-users. For countries that lack inventory and monitoring systems capable of producing annual data, this platform is a useful tool for generating consistent interpolations and extrapolations of data and provides a transparent mechanism for disseminating data.

GCS
19
TIER 1

Proportion of forest area under a long-term management plan

CONCEPTS AND DEFINITIONS

This indicator is measured as the proportion of forest area that has long-term (ten years or more) documented management plans with defined management goals and which are periodically revised. "Forest area with management plan" may refer to the forest management unit level or an aggregated forest management unit level (e.g. forest blocks, farms, enterprises, watersheds, municipalities or wider units). Management plans may include details of operations planned for individual operational units (e.g. stands or compartments), or they may be limited to the general strategies and activities planned to reach management goals. This indicator encompasses the area of forest in protected areas with management plans and also continuously updated management plans.

This is a subindicator of SDG indicator 15.2.1, for which FAO is the custodian agency.

RATIONALE/SCOPE

A forest management plan is a basis for the long-term and sustainable management of forest resources for diverse management objectives, such as the production of wood and NWFPs, the protection of soils and water, biodiversity conservation, social and cultural use, and combinations of these. An increasing area under forest management plans, therefore, is an indicator of progress towards SFM.

This indicator measures progress towards SDG target 15.2, UNSPF 2017–2030 targets 1.3 and 3.2 and the post-2020 biodiversity framework.

Tier. This is a tier 1 indicator.

DATA

Description. FAO collects data on this indicator through FRAs, which have been conducted regularly since 1946 and are now produced every five years. The latest assessment, FRA 2020, contains data on the forest area under long-term management plans for 135 countries and territories. The next update of the FRA dataset is scheduled for 2025.

Status and trends. Most (96 percent) forests in Europe have management plans; on the other hand, management plans exist for less than 25 percent of forests in Africa and less than 20 percent of forests in South America. The area of forest under management plans is increasing in all regions – globally, it has grown by 233 million ha since 2000, reaching 2.05 billion ha in 2020.

CHALLENGES AND LIMITATIONS

The FRA's current five-year cycle means it is not presently possible to produce annual updates of this indicator. The potential for more frequent voluntary reporting by countries to the FRA on key indicators is being evaluated.

GCS
20
TIER 1

Forest area under an independently verified forest management certification scheme

CONCEPTS AND DEFINITIONS

This indicator reports on the area of forest that has been independently verified for compliance with a given set of national or international standards. Forest certification schemes apply standards that generally are higher than those established by countries' own normative frameworks, and compliance is verified by independent and accredited certifiers.

RATIONALE/SCOPE

The concept of independently certifying the quality of forest management has been developed as a voluntary tool for promoting SFM and the trade of products originating in sustainably managed forests. Two major international certification schemes are in operation – the Forest Stewardship Council (FSC) and the Programme for the Endorsement of Forest Certification (PEFC). The forest area under independently verified forest management certification is a subindicator of SDG indicator 15.2.1, for which FAO is the custodian agency. FAO reports on this subindicator annually based on data provided by the secretariats of the FSC and the PEFC. As part of this process, the two secretariats have undertaken a joint analysis of areas certified under both schemes, thereby making it possible to estimate the total certified forest area without bias due to double certification.

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This indicator measures progress towards SDG target 15.2 and UNSPF 2017–2030 targets 1.3 and 3.3; it is a subindicator of SDG indicator 15.2.1.

Tier. This is a tier 1 indicator.

DATA

Description. The FSC and the PEFC submit data on forest certification to FAO annually. Data submitted by the PEFC include several national and regional certification schemes that have been endorsed according to the PEFC's standards. The total certified forest area includes the area certified by each scheme, adjusted for double-certified area.

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Status and trends. A total of 228 million ha of forest was certified under the FSC in 2021 and 330 million ha was certified under the PEFC. Of these areas, 95 million ha was certified under both systems; thus, the total net certified forest area in 2021 was 463 million ha. The majority of the certified area was in Europe and North America. Canada had by far the most, at 165 million ha, followed by the Russian Federation (72.3 million ha) and the United States of America (39.8 million ha). These three countries together accounted for almost 60 percent of the world's certified forest area in 2021.

CHALLENGES AND LIMITATIONS

An increase in certified forest area provides an indication of progress towards SFM. It should be noted, however, that significant areas of sustainably managed forest are not certified, either because their owners have chosen not to seek certification (which is voluntary and market-based) or because no credible or affordable certification scheme is in place in that area.

GCS
21
TIER 2

Existence of traceability system(s) for wood products

CONCEPTS AND DEFINITIONS

A traceability system for wood products can be defined as a system capable of tracing the origin, location and movement of wood products by means of recorded identifications. It involves two main aspects: (1) the identification of products by marking; and (2) the recording of data on the movement and location of products along the production, processing and distribution chain.

RATIONALE/SCOPE

The existence of traceability mechanisms and systems for wood products, and corresponding capacity in relevant institutions, is important for ensuring the legality of timber trade and wood products.

This indicator measures progress towards UNSPF 2017–2030 targets 3.3 and 5.2.

Tier. This is a tier 2 indicator.

DATA

Description. FRA 2020 collected data on the existence of national and subnational traceability systems for wood products.

Status and trends. Ninety-four countries and territories reported the existence of traceability systems for wood products at the national level in 2020 and another three (including the United States of America) reported that such systems exist at the subnational level; in total, these 97 countries and territories represent 84 percent of the total forest area. In South America, 13 of the 14 countries and territories that reported on this aspect indicated the existence of traceability systems for wood products. The number of countries and territories in which wood-product traceability systems exist amounted to 25 in Europe (accounting for nearly 95 percent of the region's forest area), 11 in North and Central America (91 percent), 32 in Africa (79 percent), 2 (Australia and Niue) in Oceania (72 percent), and 14 in Asia (48 percent).

CONCEPTS AND DEFINITIONS

It is difficult in some regions to track the origin of timber from harvest to product assembly because, for some product categories (e.g. pulp, paper, fibreboard and furniture), the raw materials may derive from diverse suppliers who use different species and sources of wood; another reason is that log markings are lost along the value chain (Häkli *et al.*, 2013). The language of documentation (e.g. in the chain of custody) and political barriers represent additional obstacles to effective traceability systems.

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